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PIPERACEAE PHILIPPINENSES NOVAE VEL NUPER REPERTAE [1]

Auctore C. DE CANDOLLE
(Geneva, Switzerland)

Sectio **Muldera** Hook. f. Fl. Brit. Ind. 5 (1886) 79

PIPER SARCOPODUM C. DC. sp. nov.

Ramulis glabris; foliis modice petiolatis glabris, limbo ovato-acuminato basi leviter inaequilatera utrinque obtuso apice acute acuminato, 7-plinervio, nervo centrali nervos 2 adscendentes alternos mittente quorum supremus a 1.5–2 cm supra basin solutus, nervis lateralibus adscendentibus utrinque 2 a basi solutis, petiolo basi vaginante; stirpis fem. pedunculo glabro petiolum superante, spica glabra limbum aequante vel paullo superante, receptaculo cupuliformi in apice stipitis recti et crassi, bacca globosa, stigmatibus 4 minutis rotundatis.

Dioicum. Ramuli in sicco nigri, spiciferi 3 mm crassi, collenchyma libriforme in fasciculos discretos dispositum, fasciculi intramedullares 1-seriati, canalis lysigenus centralis pluresque peripherici. Limbi in sicco firmi opaci, 9–10 cm longi, 5–6 cm lati. Petioli usque ad limbi latus longius 1.1 cm, inter limbi latera 0.2 cm, pedunculi 2 cm longi, bacca matura 4 mm crassa in sicco nigra.

LUZON, Laguna Province, *Bur. Sci. 16536 Ramos*, in forests near streams.

Sectio **Sarcostemon** C. DC. in Philip. Journ. Sci. 5 (1910) Bot. 413

PIPER KORTHALSII Miq. in Ann. Mus. Bot. Lugd. Bat. 1 (1863) 39.

LUZON, Benguet Subprovince, *Merrill 7805*, on trees in ravines, altitude about 1,500 m, stems angular, flowers greenish-yellow: Bontoc Subprovince,

[1] The species are arranged in sequence with those in my previous paper on Philippine Piperaceae, *Philip. Journ. Sci.* 5 (1910) *Bot.* 405–463. the new species being interpolated according to their relationships.

Vanoverbergh 1178, vine 3 m high in forests, altitude 1,650 m: Ifugao Subprovince, Mount Polis, *Bur. Sci. 19814 McGregor:* Cagayan Province, *Weber 1567, Bur. Sci. 13881 Ramos, For. Bur. 19559 Curran:* La Union Province, Castillo, *Loher 4522:* Laguna Province, San Antonio, *Bur. Sci. 16535 Ramos*, fruit reddish-yellow.

Sectio **Eupiper** C. DC. Prodr. 16[1] (1869) 339

PIPER COSTULATUM C. DC. in Elm. Leafl. Philip. Bot. 3 (1910) 760; Philip. Journ. Sci. 5 (1910) Bot. 420.

LUZON, Nueva Vizcaya Province, *Bur. Sci. 20071 McGregor.*

PIPER MINIATUM Blume in Verh. Bat. Genoots. 11 (1826) 166.

LUZON, Rizal Province, Montalban, *Loher 6812.* SAMAR, *Bur. Sci. 17439, 17575, 17645 Ramos.* LEYTE, *Bur. Sci. 15256 Ramos.* BASILAN, *Bur. Sci. 15466 Reillo.*

Forma b C. DC. in Philip. Journ. Sci. 5 (1910) Bot. 422.

SAMAR, *Bur. Sci. 17586 Ramos.* LEYTE, *Wenzel 721, 866.*

Forma c C. DC. l. c. 422.

LUZON, Laguna Province, San Antonio, *Bur. Sci. 12018, 14998 Ramos*, on trees; Mount Banajao, *Elmer "A,"* much branched, in clumps, fruit brownish-red. SAMAR, *Bur. Sci. 17586 Ramos.* BILIRAN, *Bur. Sci. 18856 McGregor*, in forests, altitude 500 m, fruit red. LEYTE, *Wenzel 914.* MINDANAO, Bukidnon Subprovince, *Bur. Sci. 15747 Fénix.*

PIPER FRAGILE C. DC. β **MULTINERVE** C. DC. in Philip. Journ. Sci. 5 (1910) Bot. 421.

LUZON, Tayabas Province, Mount Pular, *Bur. Sci. 19426 Ramos.*

PIPER VARIBRACTEUM C. DC. in Elm. Leafl. Philip. Bot. 3 (1910) 764.

Emend. lege: Baccis inferne in rhachi immersis.

PIPER ATROSPICUM C. DC. sp. nov.

Ramulis glabris leviter costulatis; foliis modice petiolatis glabris, limbo elliptico-lanceolato basi ima inaequilatera acuto lateribus aequilongis inaequilatis, apice acute acuminato, 6-nervio, nervis lateralibus altero latere 2 altero 3, petiolo fere usque ad medium vaginante; stirpis fem. pedunculo glabro petiolum multo superante, spica in sicco atronigra quam limbus pluries breviore apice obtusa, rhachi glabra, bracteae glabrae pelta rotunda centro pedicellata, ovario inferne in rhachi immerso, stigmatibus 3 linearibus acutis, bacca superne libera globosa et glabra.

Dioicum. Ramuli spiciferi 1.5 mm crassi in sicco nigri, collenchyma in fasciculos discretos dispositum et haud libriforme. Limbi in sicco rigidi fusci et minute pellucido-punctulati, circiter 7.8 cm longi et usque ad 3 cm lati. Petioli circiter 12 mm pedunculi 6 mm longi. Spica 1.4 cm longa et cum baccis usque ad 5 mm crassa, bracteae pelta fero 0.75 mm diam.

LEYTE, Dagami, *Bur. Sci. 15359 Ramos.*

PIPER POLISANUM C. DC. sp. nov.

Ramulis hirtellis, foliis parvis modice petiolatis, limbo ovato-acuminato basi inaequilatera oblique rotundato, apice acute acuminato, supra glabro subtus praesertim ad nervos nervulosque puberulo, 5-nervio, petiolo dense hirtello usque ad medium vaginante; stirpis fem. pedunculo puberulo petiolum superante, spica quam limbus pluries breviore, densiflora, rhachi pilosa, bracteae pelta glabra rotunda centro pedicellata, pedicello piloso, ovario libero ovato glabro, stigmatibus 3, ovatis, bacca ovato-globosa.

Dioicum. Ramuli spiciferi 1 mm crassi, in 3 mm crassis collenchyma in fasiculos discretos dispositum et haud libriforme, fasciculi intramedullares 1-seriati, canalis lysigenus unicus centralis. Limbi in sicco membranacei creberrime pellucido-punctulati, 5.5 cm longi, 2.7 cm lati. Petioli 4 mm, pedunculi 6 mm longi. Spica matura 1.5 cm longa et fere 0.5 mm crassa, bracteae pelta fere 0.75 mm diam., bacca in sicco fuscescens.

LUZON, Ifugao Subprovince, Mount Polis, *Bur. Sci. 19617, 19816 McGregor.*

PIPER PILIPES C. DC. in Philip. Journ. Sci. 5 (1910) Bot. 423.

LEYTE, Dagami, *Bur. Sci. 15364 Ramos, Wenzel 20, 717, 773, 889, 894, 948.*

PIPER RHYNCHOLEPSIS C. DC. in DC. Prodr. 16[1] (1869) 344.

SAMAR, *Bur. Sci. 17409, 17563, 17595 Ramos.* LEYTE, *Wenzel 56, 733.*

PIPER ROTUNDISTIGMUM C. DC. in Philip. Journ. Sci. 5 (1910) Bot. 425.

Adde: Stirpis masc. spica florens limbi dimidium superans, rhachis hirsuta, bracteae glabrae pelta rotunda centro pedicellata. Stamina 2, antherae ellipticae 4-valvatae quam filamenta oblonga multo breviores.

LEYTE, Dagami, *Bur. Sci. 15247, 15379 Ramos;* Palo, *Elmer 7079,* scandent, not much branched, staminate inflorescence about a foot long, curved, infructescense somewhat shorter, rigid, yellowish-red, irregularly curved.

β **PILOSIUS** C. DC. var. nov.

Ramulis villosis, limbo supra puberulo subtus hirtello; stirpis masc. spica subflorente quam limbo paullo breviore, rhachi hirsuta, bracteae glabrae pelta rotunda pedicello longiusculo, staminibus 2, antheris ellipticis 4-valvatis filamenta paullo angustiora fere aequantibus.

SAMAR, *Bur. Sci. 17434, 17653 Ramos.*

PIPER AURILIMBUM C. DC. in Elm. Leafl. Philip. Bot. 3 (1910) 768.

Adde: Stirpis masc. scandentis, pedunculo 14 mm longo, spica florente 2.5 cm longa et 3 mm crassa, rhachi et bractea ut in femina, staminibus 2, antheris rotundato-ovatis primum 4-locularibus, adultis magnis paullo ultra 1 mm longis et 2-valvatis.

LUZON, Ifugao Subprovince, Mount Polis, *Bur. Sci. 19821 McGregor:* Cagayan Province, Abulug River, *Weber 1584.*

PIPER CRASSILIMBUM C. DC. sp. nov.

Ramulis glabris; foliis breviter petiolatis glabris, limbo late ovato basi cordulato apice acute acuminato, 7-plinervio, nervo centrali nervos adscendentes 2 mittente quorum supremus a 7–15 mm supra basin solutus, nervis lateralibus utrinque 2 a basi divaricantibus, petiolo basi ima vaginante; stirpis masc. pedunculo glabro petiolum subaequante, spica florente quam limbus pluries breviore, rhachi hirsuta, bracteae pelta rotunda carnosa centro breviter pedicellata, staminibus 2 antheris rotundatis filamenta fere aequantibus; stirpis fem. pedunculo ut in mare, spica florente quam limbus pluries breviore, rhachi parce pilosa, bracteae pelta rotunda carnosa centro breviter pedicellata, ovario basi in rhachi leviter immerso superne oblongo carnoso glabro, stigmatibus 3 rotundatis carnosis.

Dioicum, scandens, 2–3 m altum. Ramuli in sicco flavicantes, spiciferi 2 mm crassi, in 3.5 mm crassis collenchyma in fasciculos discretos a latera productos sat crassos dispositum et haud libriforme, fasciculi intramedullares 1-seriati, in mare canalis lysigenus unicus centralis, in femina canalis centralis peripheriique multi, cellulae aurantiacae in cortice et in medulla crebrae. Limbi in sicco coriacei flavescentes et haud pellucido-punctulati, usque ad 12.5 cm longi et 8.7 cm lati. Petioli circiter 10 mm. Spica masc. 3.5 cm longa et inferne usque ad 3 mm crassa; spica fem. fere 2 cm longa et usque ad 3 mm crassa bracteae pelta 1.5 mm diam.

LUZON, Benguet Subprovince, Baguio, *Merrill 7649, 7660,* in thickets, limestone region, altitude about 1,550 m, flowers greenish-yellow.

PIPER PALAWANUM C. DC. sp. nov.

Ramulis glabris; foliis breviter petiolatis glabris parvis, limbo ovato basi aequilatera cordulato summo apice acuto, 7-plinervio, nervo centrali nervos 2 adscendentes mittente quorum supremus circiter a 7 mm supra basin solutus, nervis lateralibus adscendentibus utrinque 2 a basi solutis, petiolo basi ima vaginante; stirpis masc. pedunculo glabro quam petiolus multo longiore, spica limbum superante glabra, bracteae pelta rotunda centro

sat longe pedicellata, staminibus 2 antheris ovatis 4-valvatis filamenta superantibus.

Dioicum, scandens. Ramuli 1.5 mm crassi tenues et costulati, collenchyma continuum et in costulis auctum, haud libriforme, fasciculi intramedullares 1-seriati, canalis lysignus unicus centralis. Limbi in sicco membranacei, minute pellucido-punctulati, usque ad 5.5 cm longi et 2.9 cm lati. Petioli 2 mm longi.

PALAWAN, Babuyan, *Bur. Sci. 15573 Fénix*, near the seashore, flowers greenish-yellow.

PIPER RAMOSII C. DC. in Philip. Journ. Sci. 5 (1910) Bot. 426.

Adde: Stirpis fem. spica matura 1.5 cm longa, bractea ut in mare, ovarium liberum glabrum, stigmata 3 linearia, acuta, bacca ovata in vivo et in sicco rebescens, 2 mm longa.

LUZON, Rizal Province, *Bur. Sci. 19149 Reillo, Bur. Sci. 13397, 19433, 22279 Ramos.* MINDANAO, Bukidnon Subprovince, *Bur. Sci. 15783 Fénix.*

PIPER DAGAMIENSE C. DC. sp. nov.

Ramulis hirsutis; foliis sat longe petiolatis, limbo oblongo-ovato basi inaequilatera cordato apice obtusiuscule acuminato supra glabro, subtus praesertim ad nervos nervulosque hirtello, 11–13-plinervio, nervo centrali nervos adscendentes utrinque 2 mittente quorum supremus a 3.5–4.5 cm supra basin centralis solutus, nervis lateralibus utrinque 3–4 a basi divaricantibus quorum externi aliis multo tenuiores et breviores, petiolo hirsuto ultra medium vaginante; stirpis fem. pedunculo hirtello quam petiolus multo breviore, spica quam limbus pluries breviore, bracteae pelta glabra rotunda margine denticulata, pedicello brevi hirsuto, bacca inferne rhachi immersa superne libera glabra et in stilum sat longum attenuata, stigmatibus 2 oblongis apice obtusis et longitudinaliter dispositis, vel interdum 3.

Dioicum. Ramuli spiciferi circiter 4 mm crassi, collenchyma continuum haud libriforme, fasciculi intramedullares 1-seriati, canales lysigeni peripherici nulli, cellulae aurantiacae in cortice et in medulla crebrae. Limbi in sicco membranacei minute pellucido-punctulati, 18 cm longi et 8.5 cm lati. Petioli usque ad limbi latus longius 2 cm inter limbi latera 3 mm, pedunculi 1 cm longi. Spica submatura 2.5 cm longa et cum stilis usque ad 1.2 cm crassa, bracteae pelta 2 mm diam.

LEYTE, Dagami, *Bur. Sci. 15181 Ramos.*

PIPER MYRMECOPHILUM C. DC. sp. nov.

Ramulis spiciferis longe villosis; foliis brevissime petiolatis, limbo ovato basi cordato et plerumque altero latere a petiolo plus minusve latiore ac magis arcuato, apice longe et acute

acuminato, supra, praesertim inferne, ad nervum centralem piloso et haud bullato subtus glabro, 12-plinervio nervis subtus prominentibus, nervo centrali nervos 2 adcendentes alternatim mittente quorum supremus a 4 cm supra basin solutus nervisque lateralibus altero latere 4 altero 7 a basi solutis, petiolo hirsuto basi ima vaginante; pedunculo hirsuto petiolum superante, spica limbo pluries breviore obovato-cylindrica stilis dense hirta, rhachi hirsuta, bracteae pelta orbiculari parva et glabra pedicello longe villoso, bacca libera glabra oblongo-obovata superne in stilum tenuem ea pluries longiorem producta, stilo apice in stigmata 2 longitudinalia breviter bifido.

Dioicum. Ramuli spiciferi 2.5 mm crassi, pili usque ad 3 mm longi in sicco fuscescentes, collenchyma continuum et haud libriforme, zona cellularum sclerosarum subepidermidali cinctum, fasciculi intramedullares 2-seriati, canalis lysigenus centralis peripheriquique 2. Limbi in sicco firmi creberrime et minute pellucido punctati, usque ad 19 cm longi et 8 cm lati basi altero latere in saccum rotundatum et formicosum deorsum reflexi. Petioli circiter 5 mm, pedunculi 1 cm longi. Spicae fere maturae 5 cm longae cum stilis 2 cm crassae rhachis fere 3.3 mm crassa canali lysigeno centrali peripherisque pluribus munita, bracteae pelta 0.5 mm diam. pedicellus 4 mm longus; bacca fere matura 1.5 mm longa et ejus stilus 7 mm longus.

SAMAR, *Bur. Sci. 17599 Ramos.*

PIPER MERRILLII C. DC. in Philip. Journ. Sci. 5 (1910) Bot. 426.

SAMAR, *Bur. Sci. 17527 Ramos.* NEGROS, Canlaon Volcano, *Merrill 7033*, in forests, altitude about 600 m, fruit green.

PIPER PSEUDOCHAVICA C. DC. forma b C. DC. in Philip. Journ. Sci. 5 (1910) Bot. 428.

LUZON, Bontoc Subprovince, *Vanoverbergh 691.*

PIPER MAGALLANESANUM C. DC. sp. nov.

Ramulis glabris; foliis breviter petiolatis glabris, limbo oblongo-ovato basi ima aequilatera subacuto obtusove apice acute attenuato, 7-plinervio, nervo centrali nervos 2 adscendentes et alternos mittente quorum supremus fere a 1 cm supra basin solutus, nervis lateralibus utrinque 2 adscendentibus a basi solutis quorum externi aliis multo breviores, petiolo usque ad limbum vaginante; stirpis fem. pedunculo glabro petiolum paullulo superante, spica submatura quam limbus pluries breviore apice obtusa, rhachi hirsuta, bracteae pelta glabra rotunda centro pedicellata pedicello dense hirsuto, ovario libero ovato glabro, stigmatibus 3 oblongis brevibus.

Dioicum. Ramuli in sicco fusci, spiciferi 1.5 mm crassi, collenchyma continuum et haud libriforme, fasciculi intramedullares 1-seriati, canalis lysigenus unicus centralis. Limbi in sicco rigidi, minute pellucido-punctulati, usque ad 10.7 cm longi et 3.8 cm lati. Petioli 5 mm, pedunculi 7 mm longi. Spica fem. submatura, in sicco fusca, 2.5 cm longa et 4 mm crassa, bracteae pelta 1 mm diam.

SIBUYAN, Mount Giting-giting, *Elmer 12313 p. p.*

PIPER WENZELII sp. nov.

Ramulis glabris; foliis modice petiolatis glabris, limbo elliptico-lanceolato basi aequilatera acuto apice acute acuminato, 7-plinervio nervo centrali nervos adscendentes utrinque 2 mittente quorum supremus a 2–3 cm supra basin infimus paullulo supra basin centralis solutus, nervo laterali adscendente utrinque a basi soluto, petiolo basi ima vaginante, stirpis fem. pedunculo petiolum fere aequante et glabro, spica matura limbi dimidium paullo superante, bracteae pelta rotunda glabra pedicello sat longo et dense hirsuto, bacca libera obovata, stigmatibus ovatis brevibus.

Dioicum. Ramuli in sicco flavescentes, spiciferi 3 mm crassi, collenchyma continuum et libriforme, fasciculi intramedullares 1-seriati, canalis lysigenus centralis pluresque peripherici. Limbi in sicco coriacei pallescentes, usque ad 15.5 cm longi et 5.4 cm lati. Petioli fere 2 cm longi. Spica matura usque ad 9.5 cm longa et fere 4 mm crassa, bracteae pelta 1 mm diam., bacca 1.5 mm longa ut bractea in sicco rubra.

LEYTE, *Wenzel 628.*

PIPER ALBIDIRAMEUM C. DC. in Perk. Frag. Fl. Philip. (1905) 153.

LEYTE, *Wenzel 1151*, in forests, altitude about 700 m, a vine about 6 m high and 2 cm in diameter, fruit red.

Forma c C. DC. in Philip. Journ. Sci. 5 (1910) Bot. 429.

LUZON, Laguna Province, *Bur. Sci. 16597, 16630 Ramos;* Mount Banajao, *Elmer "B,"* a tall climber, fruit brick-red, branches few and quite rigid: Tayabas Province, Lucban, *Elmer 8117a.* BILIRAN, *Bur. Sci. 18706 McGregor*, in forests, altitude 500 m, fruit red. LEYTE, *Wenzel 1006.*

PIPER HIRTIRHACHE C. DC. sp. nov.

Ramulis glabris; foliis modice petiolatis glabris, limbo subovato-elliptico-lanceolato basi aequilatera acuto apice acute et sat longe acuminato, 7-plinervio nervo centrali nervos adscendentes utrinque 2 mittente, quorum supremus ex 2.5 cm supra basin solutus nervo laterali adscendente utrinque a basi soluto, petiolo basi ima vaginante, stirpis masc. pedunculo glabro petiolum fere

aequante, staminibus 2, antheris 4-valvatis filamenta brevia aequantibus, stirpis fem. pedunculo glabro petiolum paullo vel usque ad duplo superante, spica florente limbi dimidium superante, rhachi dense hirsuta, bracteae pelta rotunda glabra centro breviter pedicellata pedicello hirsuto, ovario libero ovato, stigmatibus ovato-acutis.

Dioicum. Ramuli spiciferi fere 3 mm crassi, collenchyma continuum libriforme, fasciculi intramedullares 1-seriati, canalis lysigenus unicus centralis. Limbi in sicco firme membranacei pallidi epunctati, in mare usque ad 17.5 cm longi et 4.5 cm lati, in femina usque ad 17 cm longi et 5.5 cm lati. Petioli 11 mm, pedunculi 22 mm longi. Spica florens 10 cm superans et fere 2 mm crassa, rhachis in mare et in femina canali lysigeno centrali peripheriсisque multis munita, bracteae pelta fere 1 mm diam. in sicco pallide fuscescens.

LEYTE, *Wenzel 1168, 819, 1197* spec. femin., *779* spec. masc., *891* spec. masc. cum staminibus in staminoidia mutatis.

PIPER VILLIRHACHE C. DC. sp. nov.

Ramulis glabris crassis; foliis modice petiolatis glabris, limbo amplo subobovato-elliptico basi leviter inaequilatera utrinque acuto summo apice apiculato, 13- ad 17-plinervio nervo centrali nervos adscendentes utrinque 4–6 mittente quorum supremus alte supra medium centralis solutus, nervis lateralibus adscendentibus utrinque 2 a basi solutis, petiolo basi ima vaginante; stirpis fem. pedunculo glabro quam petiolus breviore, spica quam limbus pluries breviore, rhachi dense villosa, bracteae pelta glabra obovata centro longe pedicellata pedicello villoso, floribus dense condensis, ovario libero glabro ovato apice attenuato, stigmatibus 3–4 oblongis, bacca ovato-globosa glabra.

Dioicum scandens. Ramuli in sicco fuscescentes, spiciferi fere 7 mm crassi, collenchyma continuum haud libriforme, fasciculi intramedullares 1-seriati, cellulae fuscescentes in cortice et in medulla creberrimae. Limbi in sicco firme membranacei creberrime et praesertim secus nervulos pellicido-punctulati, punctulis rubris, superi 25.5 cm longi et 14 cm lati. Petioli usque ad limbi latus longius 3 cm, inter limbi latera 4 mm pedunculi 2 cm longi. Spica matura 6.5 cm longa et 6 mm crassa, rhachis canali lysigeno unico centrali munita, bracteae pelta 1.5 mm longa, bacca 2 mm longa et 1.75 mm lata, in vivo rubra, in sicco fulvescens.

MINDANAO, Bukidnon Subprovince, Sumilao, *Bur. Sci. 15773 Fénix*, a vine on trees, locally known as *tugpuan*.

PIPER PSILOCARPUM C. DC. sp. nov.

Ramulis glabris; foliis sat longe petiolatis glabris, limbo elliptico basi aequilatera acuto apice acute acuminato, 9-ninervio nervo centrali nervum adscendentem utrinque fere a 3 cm supra basin mittente, nervis lateralibus adscendentibus utrinque 3 a basi solutis, petiolo basi ima vaginante; stirpis fem. pedunculo glabro quam petiolus breviore, spica florente quam limbus pluries breviore glabra apice obtusa, bracteae pelta rotunda centro breviter pedicellata, ovario inferne in rhachi immerso superne libero et conoideo, stigmatibus 4 ovatis apice acutiusculis.

Dioicum, ut videtur erectum. Ramuli in sicco fuscescentes, spiciferi 2 mm crassi, collenchyma libriforme in fasciculos discretos dispositum, fasciculi intramedullares 1-seriati, canalis lysigenus centralis pluresque peripherici. Limbi in sicco subrigide membranacei minutissime pellucido-punctulati usque ad 20 cm longi et 2.8 cm lati. Petioli 3 cm, pedunculi 1.5 cm longi. Spica florens 2.8 cm longa et cum ovariis 5 mm crassa, rhachis canali lysigeno unico centrali munita, bracteae pelta 1 mm diam.

LEYTE, Jaro, *Wenzel 896*, in forests, altitude 500 m.

PIPER MACGREGORII sp. nov.

Ramulis glabris; foliis longiuscule petiolatis glabris, limbo oblongo-ovato basi leviter inaequilatera utrinque obtuso apice obtusiuscule acuminato, 7-plinervio nervo centrali nervos adscendentes utrinque 2 mittente quorum supremus fere a 4 cm supra basin infimusque fere a basi soluti et nervo laterali utrinque a basi soluto aliis magis arcuato ac multo tenuiore brevioreque, petioli basi ima vaginante; pedunculo glabro petiolum superante et tenui, spica florente quam limbus pluries breviore cylindrica et apice mucronulata, rhachi puberula, bracteae glabrae pelta rotunda late sessili, ovario inferne in rhachi profunde immerso superne emerso glabro, stigmatibus brevibus ovato-acutis.

Dioicum. Ramuli spiciferi 2 mm crassi in sicco fuscescentes, in 3 mm crassis collenchyma libriforme in fasciculos discretos dispositum, fasciculi intramedullares 1-seriati, canalis lysigenus centralis peripherique plures. Limbi in sicco membranacei minutissime pellucido-punctulati, usque ad 17.5 cm longi et 7.3 cm lati. Petioli usque ad limbi latus longius 2 cm inter limbi latera 2 mm longi. Pedunculi 3.7 cm longi. Spicae 1.9 cm longae et circiter 4 mm crassae, rhachis canali lysigeno centrali peripherisque pluribus munita, bracteae 1 mm diam.

BILIRAN, *Bur. Sci. 18491 McGregor*, altitude 300 m.

PIPER BETLE Linn. Sp. Pl. (1753) 28.

LUZON, Camarines Province, *Bur. Sci. 22134 Ramos:* Laguna Province, *Bur. Sci. 15053, 16639 Ramos.*

Forma b C. DC. in Philip. Journ. Sci. 5 (1910) Bot. 431.

LUZON, Laguna Province, Los Baños, *Bur. Sci. 9689 Robinson,* in forests, altitude about 30 m: Tayabas Province, Tagcauayan, *Bur. Sci. 13386 Ramos:* Bulacan Province, Norzagaray, *Bur. Sci. 13031 Ramos:* Rizal Province, *Bur. Sci. 13534 Ramos,* flowers yellow.

Forma c C. DC. l. c.

LUZON, Nueva Vizcaya Province, near Dupax, *Bur. Sci. 14172, 14179 Ramos:* Bataan Province, *For. Bur. 23212 Alambra & Caulas.* PANAY, Iloilo Province, *Bur. Sci. 18153 Robinson.*

PIPER SARCOSTYLUM C. DC. sp. nov.

Ramulis glabris; foliis breviter petiolatis glabris, limbo elliptico-lanceolato basi aequilatera acuto apice acute acuminato; 7-plinervio nervo centrali nervos adscendentes utrinque 2 opposite mittente quorum supremi a 2.5 cm supra basin soluti, nervo laterali adscendente utrinque, a basi soluto, petiolo basi ima vaginante; stirpis fem. pedunculo glabro petiolum paullulo superante, spica florente quam limbus pluries breviore, rhachi hirsuta, bracteae glabrae pelta rotunda centro subsessili, ovario inferne in rhachi immerso superne in stilum carnosum oblongum glabrum producto, stigmatibus 3 ovatis brevibus.

Dioicum, in arboribus scandens. Ramuli in sicco fusci, spiciferi 1 mm crassi, collenchyma fere omnino libriforme in fasciculos discretos a latere productos dispositum, fasciculi intramedullares 1-seriati, canalis lysigenus unicus centralis, zona cellularum sclerosarum cum phloemate fasciculorum periphericorum continua, cellulaeque sclerosae in cortice glomerulatim dispositae. Limbi in sicco rigidi creberrime pellucido-punctulati, usque ad 10.5 cm longi et 4.2 cm lati. Petioli 5 mm, pedunculi 8 mm longi. Spica florens 2 cm longa et usque ad 8 mm crassa, bracteae pelta 0.5 mm diam., stilus paullo ultra 0.5 mm longus. Species *P. chabae* Bl. proxima.

MINDANAO, Butuan Subprovince, Agusan River, *Merrill 7305.*

PIPER CHABA Blume Verh. Bat. Genoots. 11 (1826) 168.

LUZON, Laguna Province, San Antonio, *Bur. Sci. 16608, 20520, 20582 Ramos;* Mount Maquiling, *Bur. Sci. 17003 Robinson:* Camarines Province, Mount Isarog, *Bur. Sci. 22077 Ramos.* LEYTE, Dagami, *Wenzel 40, 802, Bur. Sci. 15503 Ramos.*

PIPER RHOMBOPHYLLUM C. DC. Prodr. 16[1] (1869) 352.

LUZON, Tayabas Province, *Bur. Sci. 13282 Ramos:* Camarines Province, *Bur. Sci. 22150 Ramos.* SAMAR, *Bur. Sci. 17507 Ramos.* LEYTE, *Elmer 7080.*

PIPER FUSCESCENTIRAMEUM C. DC. sp. nov.

Ramulis glabris; foliis modice petiolatis glabris, limbo elliptico-lanceolato basi aequilatera acuto apice acute acuminato, 9-ninervio, nervo centrali nervos adscendentes 2 alternatim mittente quorum supremus a 3 cm supra basin solutus, nervis lateralibus utrinque 3 a basi solutis quorum 2 adscendentes tertius subadscendens aliis multo tenuior ac brevior, petiolo basi ima vaginante; pedunculo glabro quam petiolus multo breviore, spica cylindrica florens quam limbus pluries breviore, rhachi hirsuta, bracteae glabrae pelta rotunda centro breviter pedicellata, ovario rhachi immerso superne in stilum liberum sat longum conicum et glabrum producto, stigmatibus ovatis.

Dioicum, scandens. Ramuli in sicco fuscescentes, spiciferi 1 mm crassi, in 4 mm crassis collenchyma libriforme in fasciculos discretos dispositum, fasciculi intramedullares 1-seriati, canalis lysigenus centralis peripherique plures. Limbi in sicco firme membranacei pellucido punctulati, superi usque ad 19 cm longi et 7.7 cm lati. Petioli 2.5 cm pedunculi 0.6 cm longi. Spica florens 1 cm longa cum stilis 4 mm crassa, in vivo alba in sicco fuscescens, rhachis canali lysigeno unico centrali munita, bracteae pelta 1 mm diam., stigmata 3.

LEYTE, *Wenzel 1184*, a vine in forests, altitude about 500 m, flowers white.

PIPER VIMINALE Opiz in Presl Rel. Haenk. 1 (1828) 150, *t. 26*.

LUZON, Laguna Province, San Antonio, *Bur. Sci. 20400 Ramos*. CAMIGUIN, *Bur. Sci. 14645, 14685 Ramos*.

PIPER CAGAYANENSE C. DC. in Philip. Journ. Sci. 5 (1910) Bot. 435.

LUZON, Cagayan Province, *Bur. Sci. 13838 Ramos*, on trees in forests.

PIPER PODANDRUM C. DC. in Philip. Journ. Sci. 5 (1910) Bot. 436.

LUZON, Rizal Province, *Loher 6008*.

PIPER CALVIFOLIUM C. DC. sp. nov.

Ramulis glabris; foliis breviter petiolatis glabris, limbo elliptico-subovato-lanceolato basi aequilatera acuto, apice acute et sat longe acuminato, 5-plinervio, nervo centrali nervos 2 adscendentes mittente quorum supremus a 7–15 mm supra basin solutus, nervo laterali utrinque a basi soluto, petiolo usque ad limbum vaginante; stirpis masc. pedunculo glabro petiolum superante, spica florente quam limbus pluries breviore, rhachi hirsuta, bracteae pelta glabra rotunda centro pedicellata pedicello hirsuto, staminibus 2 antheris ovatis quam filamenta longioribus.

Ramuli spiciferi fere 1 mm crassi, collenchyma in fasciculos discretos dispositum et haud libriforme, fasciculi intramedullares 1-seriati, canalis lysigenus unicus centralis, pholoema inter fas-

ciculos peripherícos continuum. Limbi in sicco membranacei minute et inconspicue pellucido-punctulati, 8.5–9 cm longi 2.5–2.8 cm lati. Petioli fere 4 mm pedunculi 10 mm longi. Spica florens 1.7 cm longa at 1.5 mm crassa, rhachis sine canali lysigeno, bracteae pelta 0.5 mm diam.

LUZON, *Loher 6794 p. p.*, h. Monac. ex h. Kew.

PIPER POLYCLADUM C. DC. in Philip. Journ. Sci. 5 (1910) Bot. 438.

LUZON, Benguet Subprovince, Baguio, *Phil. Pl. 751 Merrill*, in thickets, limestone region, altitude 1,500 m, flowers yellow: Rizal Province, *Bur. Sci. 18396 Ramos*, on trees in forests.

PIPER SARMENTOSUM Roxb. Fl. Ind. 1 (1820) 162.

NEGROS, Cabancalan, *Merrill 6729*. CAMIGUIN, Mambajao, *Elmer 14245*.

Forma b C. DC. forma nova.

Limbo brevius acuminato.

MINDANAO, Davao District, *Piper 449*.

PIPER CORYLISTACHYON C. DC. Prodr. 16 [1] (1869) 346.

LUZON, Laguna Province, San Antonio, *Bur. Sci. 20527, 12030 Ramos:* Rizal Province, Antipolo, *Bur. Sci. 11867 Robinson:* Tayabas Province, *Bur. Sci. 13324 Ramos:* Pangasinan Province, Umingan, *Bur. Sci. 18338 Otanes*. SAMAR, *Bur. Sci. 17420 Ramos*. BILIRAN, *Bur. Sci. 18785 McGregor*. MINDANAO, Davao District, *Bur. Sci. 15859 Fénix*. LEYTE, Malitbog, *Weber 1523*.

Forma b C. DC. in Philip. Journ. Sci. 5 (1910) Bot. 439.

LUZON, Camarines Province, *Philip. Pl. 1575 Ramos*. BILIRAN, *Bur. Sci. 18775 McGregor*. LEYTE, *Elmer 7083*.

Forma d C. DC. l. c.

LUZON, Rizal Province, *Loher 6801:* Cagayan Province, *Bur. Sci. 13882 Ramos*, on trees in damp forests, flowers yellowish-white.

PIPER REINWARDTIANUM C. DC. Prodr. 16[1] (1869) 354.

PANAY, Iloilo Province, *Bur. Sci. 18134 Robinson*.

PIPER RETROFRACTUM Vahl Enum. 1 (1804) 314.

BABUYANES ISLANDS, Dalupiri, *Bur. Sci. 10638, 10651 McGregor:* CAMIGUIN, *Bur. Sci. 4092 Fénix*. LUZON, Rizal Province, *Bur. Sci. 11841 Robinson*, fruit dark-red: Laguna Province, Jala-Jala, *Bur. Sci. 11935 Robinson & Ramos*. MINDORO, *Merrill 3342*, near the seashore. PALAWAN, *Bur. Sci. Weber, Bur. Sci. 190 Bermejos*, Ulugan Bay, *Merrill 7216*, in coconut groves at sea level, *Bur. Sci. 851 Foxworthy*, in forests along streams, growing on trees and shrubs.

PIPER PENNINERVE C. DC. in Perk. Frag. Fl. Philip. (1905) 157.

Adde: Stirpis masc. spica canali lysigneo centrali peripherisque munita, rhachis glabra, bracteae pelta rotunda centro pedicellata, stamina 2, antherae 4-valvatae tetragonae.

LEYTE, Jaro, *Wenzel 719*, in forests, altitude 500 m.

PIPER PERPUNCTATUM C. DC. sp. nov.

Ramulis tantum ad nodos parce puberulis; foliis modice petiolatis, limbo ovato basi aequilatera rotundato apice acute acuminato, supra glabro subtus parce pilosulo, 5-plinervio nervo centrali nervos 2 adscendentes oppositos a 5 mm supra basin mittente, nervo laterali patule adscendente utrinque a basi soluto, petiolo superne parce pilosulo paullo ultra medium vaginante; stirpis masc. pedunculo glabro petiolum aequante tenui, spica florente quam limbus pluries breviore apice attenuata, rhachi hirsuta, bracteae glabrae pelta rotunda margine undulata centro subsessili, staminibus 2, antheris parvis rotundatis 4-valvatis, filamenta oblonga aequantibus.

Dioicum, scandens. Ramuli in sicco nigri, spiciferi 0.5 mm crassi, collenchyma libriforme in fasciculos discretos a latere productos dispositum, fasciculi intramedullares 1-seriati, canalis lysigenus unicus centralis. Limbi in sicco tenuiter membranacei creberrime pellucido-puntati, superi 7 cm longi et 4 cm lati, subsequentes rotundato-ovati basi cordati apice acute acuminati 7 cm longi et 5.6 cm lati. Petioli superi 4 mm, subsequentes usque ad 20 mm longi. Spica florens 9 mm longa fere usque ad 1.5 mm crassa, bracteae pelta 0.55 mm diam.

PALAWAN, Malampaya Bay, *Merrill 7246*, on trees in forests, altitude about 8 m, flowers green.

PIPER DELICATUM C. DC. in Philip. Journ. Sci. 5 (1910) Bot. 443.

LUZON, Benguet Subprovince, Mount Tonglon, *Phil. Pl. 750 Merrill*, mossy forest, altitude about 1,900 m, a vine 1 to 3 m high growing on tree trunks, flowers pale yellow: Ifugao Subprovince, Mount Polis, *Bur. Sci. 19815 McGregor:* Bontoc Subprovince, *Vanoverbergh 1140*, in forests, altitude about 1,600 m: Camarines Province, Mount Isarog, *Bur. Sci. 22061 Ramos.*

Forma b C. DC. forma nova.

Foliis minoribus, limbo usque ad 4 cm longo et 1 cm lato.

LUZON, Benguet Subprovince, Pauai, *Mrs. Clemens 9160.*

PIPER LONGIVAGINANS C. DC. in Philip. Journ. Sci. 5 (1910) Bot. 444.

LUZON, Camarines Province, Mount Isarog, *Bur. Sci. 22057 Ramos.*

Forma b C. DC. forma nova.

Foliis minoribus, limbo usque ad cm longo et 1 cm lato.

LUZON, Province of Rizal, *Loher 6789, 6811.* SIBUYAN, *Elmer 12313 p. p.*

PIPER EUPODUM C. DC. sp. nov.

Ramulis junioribus haud dense hirsutis; foliis modice petiolatis, limbo ovato-acuminato basi fere aequilatera in mare rotundato in femina acuto, apice acute acuminato, supra tantum inferne et subtus ubique ad nervos nervulosque haud dense hirtello,

7-plinervio nervo centrali paullo supra basin trifido nervis lateralibus utrinque 2 a basi solutis, petiolo sat dense hirsuto basi vaginante; pedunculo parce hirtello petiolum triplo superante; spica subflorente quam limbus longiore, in mare rhachi dense hirsuta, bracteae pelta glabra rotundato-obovata pedicello sat longo basi parce piloso, staminibus, 2 antheris ellipticis 4-valvatis quam filamenta aequilata multo brevioribus, in femina rhachi hirsuta foveataque, bracteae pelta glabra transverse elliptica centro pedicellata pedicello hirsuto, baccis condensis obovato-oblongis glabris, stigmatibus 3 oblongis brevibus et hirtellis.

Frutex scandens. Ramuli spiciferi 1 mm crassi, collenchyma in fasciculos discretos dispositum, libriforme, fasciculi intramedullares 1-seriati, canalis lysigenus unicus centralis. Limbi in sicco membranacei minute pellucido-punctulati, superi 6.5 cm longi et 3.5 cm lati. Petioli fere 1 cm, pedunculi 3.5 cm longi. Spica subflorens 8.5 cm longa et usque ad 2.5 mm crassa, bracteae pelta 0.75 mm longa.

LEYTE, Dagami, *Bur. Sci. 15227 Ramos*, masc., in forests, altitude 500 m, *Wenzel 1005*, fem., a vine, fruit green.

PIPER LEYTEANUM C. DC. sp. nov.

Ramulis velutine puberulis; foliis sat longe petiolatis, limbo oblongo-ovato basi fere aequilatera cordato apice acute acuminato, utrinque velutine puberulo; nervo centrali nervos adscendentes utrinque 4 mittente, quorum supremus a 5–7 cm supra basin centralis solutus, nervis lateralibus utrinque 3–4 a basi divaricantibus, petiolo hirtello et velutine puberulo paullo ultra basin vaginante; stirpis masc. pedunculo fere glabro petiolum superante, spica suflorente quam limbi dimidium paullo longiore, rhachi hirsuta, bracteae glabrae pelta rotunda centro sat longe pedicellata, staminibus 2, antheris 4-valvatis.

Ramuli spiciferi 2.5 mm crassi, collenchyma in fasciculos discretos dispositum et zona interna vel fere omnino libriforme, fasciculi intramedullares 1-seriati, canalis lysigenus centralis nullus, peripherici plures. Limbi in sicco membranacei inconspicue pellucido-punctulati, 15–20.5 cm longi, 8.5–9 cm lati. Petioli 2 cm, pedunculi 3.5 cm longi. Spica subflorens 2 mm crassa, bracteae pelta fere 0.75 mm diam.

LEYTE, Dagami, *Wenzel 214*.

PIPER OVATIBACCUM C. DC. in Elm. Leafl. Philip. Bot. 3 (1910) 782.

LUZON, Laguna Province, Mount Banajao, *Bur. Sci. 9755, 9759 Robinson;* San Antonio, *Bur. Sci. 20418, 20423, 20486 Ramos:* Tayabas Province, Mount Pular, *Bur. Sci. 19370 Ramos.* LEYTE, *Wenzel 735, 1114, 1162, Bur. Sci. 15363 Ramos*, in forests, altitude 500 m, fruit scarlet.

PIPER CHLOROCARPUM C. DC. sp. nov.

Ramulis villosis; foliis modice petiolatis, limbo ovato-lanceolato basi ima leviter inaequilatera anguste cordulato apice acute et sat longe acuminato supra et subtus densius piloso, nervo centrali nervos adscendentes utrinque 4 mittente quorum supremus a 2 cm supra basin solutus, petiolo villoso usque ad medium vaginante; stirpis fem. pedunculo tenui parce piloso petiolum multo superante, spica limbi dimidium subaequante apice rotundata, densiflora, rhachi pilosa, bracteae pelta rotunda glabra centro sat longe pedicellata pedicello piloso, bacca libera oblonga obovata glabra, stigmatibus 3 ovatis brevibus.

Dioicum. Ramuli 2 mm crassi, collenchyma libriforme in fasciculos discretos dispositum, fasciculi intramedullares 1-seriati, canalis lysigenus unicus centralis. Limbi in sicco firmi, pellucido-punctulati 15.5 cm longi et usque ad 5.2 cm lati. Petioli usque ad limbi latus longius 7 mm, inter limbi latera 2 mm longi. Pedunculi 4.5 cm longi. Spica in vivo viridis, matura 7.5 cm longa et 0.6 cm crassa, bracteae pelta fere 0.75 mm diam.

LUZON, Laguna Province, San Antonio, *Bur. Sci. 16638 Ramos.*

PIPER AGUSANENSE C. DC. in Elm. Leafl. Philip. Bot. 6 (1914) 2291.

CAMIGUIN, *Bur. Sci. 14644 Ramos.*

PIPER TOPPINGII C. DC. in Philip. Journ. Sci. 5 (1910) Bot. 446.

LUZON, Benguet Subprovince, Mount Tonglon, *Merrill 7770*, vine 2 to 3 m long, on trees, altitude about 2,000 m; Baguio, *Bur. Sci. 14114 Robinson:* Ifugao Subprovince, Mount Polis, *Bur. Sci. 19818 McGregor:* Rizal Province, San Isidro, *Phil. Pl. 274 Ramos.*

PIPER OVATIBRACTEUM C. DC. in Elm. Leafl. Philip. Bot. 3 (1910) 784.

LUZON, Tayabas Province, *Bur. Sci. 13368 Ramos.* MINDANAO, Butuan Subprovince, Agusan River at Talacogon, *Merrill 7316*, on trunks of palms and other trees, flowers yellowish. CAMIGUIN, *Bur. Sci. 14646, 14771 Ramos.*

PIPER LONGILIMBUM C. DC. sp. nov.

Ramulis tantum ad nodos hirtellis; foliis breviter petiolatis, limbo elliptico-lanceolato basi leviter inaequilatera acuto apice longe et acute acuminato, supra glabro subtus hirsuto, nervo centrali nervos subrectos adscendentes utrinque 11–12 mittente quorum supremus a 16 cm supra basin solutus, petiolo hirsuto basi vaginante; pedunculo parce piloso quam petiolus breviore, spica subflorente quam limbi dimidium paullo breviore, rhachi pilosa, bracteae glabrae pelta rotunda centro pedicellata, staminibus 2 antheris obovatis filamenta tenuis superantibus connectivo ultra thecas peltatim et tenuiter producto.

Dioicum. Ramuli in sicco complanati fere 5 mm crassi, col-

lenchyma in fasciculos discretos a latere valde productos dispositum et haud libriforme, fasciculi intramedullares 1-seriati, canalis lysigenus unicus centralis, cellulae fuscescentes in cortice et in medulla crebrae. Limbi in sicco membranacei epunctati, usque ad 27 cm longi et 9 cm lati. Petioli usque ad limbi latus longius 10 mm, inter limbi latera 3 mm longi. Pedunculi 8 mm longi. Spicae 10.5 cm longae et circiter 2 mm crassae canali lysigeno unico centrali munitae, bracteae pelta fere 0.5 mm diam.

SAMAR, *Bur. Sci. 17603 Ramos.*

PIPER INTERRUPTUM Opiz in Presl Rel. Haenk. 1 (1828) 157.

LUZON, Rizal Province, San Isidro, *Phil. Pl. 267 Ramos:* Cagayan Province, Abulug River to Linao, *For. Bur. 11611 Curran:* Nueva Vizcaya Province, *Bur. Sci. 20144 McGregor.*

Forma b C. DC. in Philip. Journ. Sci. 5 (1910) Bot. 448.

LUZON, Laguna Province, Calauan, *Bur. Sci. 12425 McGregor.*

Forma c C. DC. forma nova.

Limbo minore et angustiore, nempe usque ad 9 cm longo et 3 cm lato antheris quam filamenta adulta oblonga multo brevioribus.

LUZON, Bontoc Subprovince, Bauco, *Vanoverbergh 1184, 558,* in forests, altitude 1,250 to 1,690 m.

PIPER SUBARBORESCENS C. DC. in Philip. Journ. Sci. 5 (1910) Bot. 449.

LUZON, Rizal Province, *For. Bur. 3299 Ahern's collector, Bur. Sci. 22278 Ramos.*

PIPER PULOGENSE C. DC. in Philip. Journ. Sci. 5 (1910) Bot. 453.

Species propter baccam vix stipitatam hic collocanda.

LUZON, Benguet Subprovince, Mount Tonglon, *Phil. Pl. 749 Merrill,* vine 2 to 3 m high on trees, altitude 2,200 m, flowers green.

PIPER MULTISTIGMUM C. DC. sp. nov.

Ramulis glabris; foliis modice petiolatis glabris, limbo ovato-acuminato basi ima aequilatera acuto apice acute acuminato, 5-nervio, petiolo ultra medium vaginante; stirpis fem. pedunculo glabro petiolum paullo superante, spica quam limbus fere duplo longiore, rhachi pilosa, bracteae glabrae pelta obovato-oblonga apice rotundata deorsum attenuata et tantum marginibus libera, ovario glabro libero, stigmatibus 5–6 linearibus apice acutis, bacca matura ovato-globosa.

Dioicum. Ramuli spiciferi fere 1.5 mm crassi in sicco nigrescentes, collenchyma libriforme in fasciculos discretos dispositum, fasciculi intramedullares 1-seriati, canalis lysigenus unicus

centralis. Limbi in sicco membranacei pellucido-punctulati, 8.8 cm longi, 3.5 cm lati. Petioli 1 cm, pedunculi usque ad 1.6 cm longi. Spica baccifera usque ad 15.5 cm longa, rhachis canali lysigeno unico centrali munita, bractea fere 5.5 longa et apice 1 mm lata, bacca in sicco fuscescens, fere 4 mm longa.

LUZON, Ifugao Subprovince, Mount Polis, *Bur. Sci. 19819 McGregor.*

PIPER LOHERI C. DC. in Philip. Journ. Sci. 5 (1910) Bot. 450.

LUZON, Laguna Province, Calauan, *Bur. Sci. 12421 McGregor:* Rizal Province, Montalban, *Phil. Pl. 269 Merrill, Bur. Sci. 11840 Robinson.*

Forma c C. DC. forma nova.

Limbo 5-nervio, rotundato-ovato-lanceolato basi aequilatera acuto apice acute acuminato, usque ad 7 cm longo et 4–8 cm lato.

LUZON, Union Province, Bauang, *Bur. Sci. 12983 Fénix.*

Forma b multiplinerve C. DC. l. c.

LUZON, Bulacan Province, Norzagaray, *Bur. Sci. 12242 Foxworthy,* fruit orange.

PIPER SAMARANUM C. DC. sp. nov.

Ramulis glabris, foliis modice petiolatis glabris, limbo ovato-lanceolato basi leviter inaequilatera utrinque acuto apice acute acuminato, 5-plinervio nervo centrali nervos adscendentes 2 alterne vel opposite mittente quorum supremus a 1 cm supra basin solutus, nervis lateralibus adscendentibus utrinque 2 a basi solutis quorum externus aliis multo tenuior et brevior, petiolo tenui basi vaginante; pedunculo glabro petiolum multo superante, spica quam limbus fere duplo longiore, glabra, bractea subobovato-oblonga inferne attenuata apice rotundata, baccis condensis subglobosis, stigmatibus ovato-acutis.

Dioicum. Ramuli in sicco cinerescentes, spiciferi 1.75 mm crassi, collenchyma fere omnino libriforme in fasciculos discretos dispositum, fasciculi intramedullares 1-seriati, canalis lysigenus nullus. Limbi in sicco cinerescentes firmi inconspicue et minute pellucido-punctulati, circiter 7.7 cm longi et 2.7 cm lati. Petioli usque ad 0.7 cm, pedunculi 2 cm longi. Spica 13.5 cm longa, bractea apice paullo ultra 1 mm lata, bacca 3.5 mm longa, in sicco fuscescens.

SAMAR, *Bur. Sci. 17546 Ramos.*

PIPER NIGRUM Linn. forma **GLABRISPICA** C. DC. forma nova.

Stirpis masc. rhachi glabra.

MINDANAO, Butuan Subprovince, Lake Liluan, *Weber.*

PIPER ARBORISEDENS C. DC. sp. nov.

Ramulis glabris; foliis modice petiolatis glabris, limbo subovato-lanceolato basi aequilatera acuto apice acute et sat longe

acuminato, 5- ad 7-plinervio, nervo centrali nervos 2 adscendentes alternos mittente quorum supremus a 10 mm supra basin solutus, nervo laterali unico vel nervis lateralibus 2 adscendentibus utrinque a basi solutis, quorum externus aliis multo tenuior et brevior, petiolo fere usque ad medium vaginante; stirpis fem. pedunculo glabro petiolum fere aequante, spica matura limbi dimidium fere aequante, rhachi hirsuta, bracteae glabrae pelta obovata centro sessili, ovario libero ovato glandulis subasperato, stigmatibus 3 ovato-acutis, bacca oblongo-ovata glabra stipitem suum glabrum multo superante.

Dioicum, in arboribus scandens. Ramuli in sicco fusci, spiciferi 5 mm crassi, collenchyma in fasciculos discretos a latere productos dispositum et zona interna libriforme, canalis lysigenus unicus centralis. Limbi in sicco rigide membranacei pellucido-punctulati, usque ad 11 cm longi et 3.5 cm lati. Petioli circiter 12 mm longi. Spica fem. matura 5 cm longa, subdensibacca, bracteae pelta 1.5 mm longa et usque ad 1 mm lata, bacca 6 mm longa usque ad 3.5 mm lata, in sicco nigra.

LUZON, Laguna Province, San Antonio, *Bur. Sci. 24934 Ramos.*

PIPER MARIVELESANUM C. DC. in Philip. Journ. Sci. 5 (1910) Bot. 457.

LUZON, Rizal Province, Montalban, *Loher 6792:* Laguna Province, San Antonio, *Bur. Sci. 10952 Ramos,* fruit red: Tayabas Province, Tagcauayan, *Bur. Sci. 13349 Ramos.*

PIPER CANINUM Blume in Verh. Bat. Genoots. 11 (1826) 214.

LUZON, Ifugao Subprovince, Mount Polis, *Bur. Sci. 19820 McGregor:* Camarines Province, Sagnay, *Bur. Sci. 22133 Ramos.* SAMAR, *Bur. Sci. 17508 Ramos.* LEYTE, *Wenzel 856.* MINDANAO, Surigao Province, *Piper 244, 245.* CAMIGUIN, *Bur. Sci. 14645, 14672, 14685, 14699 Ramos.* PALAWAN, Malampaya Bay, *Merrill 7213,* on small trees in forests, flowers green.

PIPER MERRITTII C. DC. in Philip. Journ. Sci. 5 (1910) Bot. 460.

LUZON, Camarines Province, Mount Isarog, *Bur. Sci. 22623 Ramos:* Laguna Province, San Antonio, *Bur. Sci. 16537 Ramos.* SAMAR, *Bur. Sci. 17557 Ramos.*

β **parvifolium** C. DC. var. nov.

Limbo rotundato basi cordato apice acute acuminato, 7 cm longo, 4.7 cm lato.

LEYTE, *Wenzel 1095,* a vine in forests, altitude 500 m.

PIPER VILLILIMBUM C. DC. in Philip. Journ. Sci. 5 (1910) Bot. 461.

LUZON, Cagayan Province, *Bur. Sci. 13895 Ramos:* Tayabas Province, Mount Banajao, *Elmer "C."* CAMIGUIN, *Bur. Sci. 14472 Ramos.*

Sectio **Heckeria** Hook. f. Fl. Brit. Ind. 6 (1886) 95

PIPER UMBELLATUM Linn. Sp. Pl. (1753) 43, var. **SUBPELTATUM** C. DC. in Donn.-Sm. Enum. 6: 39.

LUZON, Laguna Province, Mount Maquiling, *Bur. Sci. 16897 Serviñas;* Pililla-Mavitak trail, *Bur. Sci. 11946 Robinson & Ramos;* Benguet Subprovince, Sablan, *Bur. Sci. 12694 Fenix.* BASILAN, *Bur. Sci. 15456 Reŭlo.* CAMIGUIN, *Bur. Sci. 14723 Ramos.* MINDANAO, Bukidnon Subprovince, *Bur. Sci. 15787 Fenix.*

Var. **GLABRUM**, forma b, C. DC. in Bull. Herb. Boiss. 6 (1898) 494.

LUZON, Laguna Province, Calauan, *Bur. Sci. 12414 McGregor.*

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GROWTH PHENOMENA OF DIOSCOREA

By EDWIN BINGHAM COPELAND
(From the College of Agriculture, University of the Philippines, Los Baños, P. I.)

Studies of *Dioscorea* of several kinds have been in progress at the College of Agriculture during the past three years. These studies, before this year, have included the systematic determinations (by Mr. I. H. Burkill), the preparation of keys for the identification of varieties, the investigation of behavior in the field of a large number of forms, studies of their chemical and culinary characteristics, and growth studies. Considerable information as to the growth of different varieties, with notes as to growth movements, was collected by Mr. Mariano Raymundo in the preparation of a thesis, publication of which is delayed until Mr. Raymundo's return from America.

As a feature of the irregular postal service during these years of war, reviews of the Pfeffer Festschrift [1] reached Manila in advance of the Festschrift itself. From one of these reviews I learned of Professor Newcombe's work, "Das Verhalten der Windepflanzen in der Dunkelheit," [2] and was immediately struck by the natural advantages with which *Dioscorea* would lend itself to such study. It presently developed that Duchartre [3] had long since used *Dioscorea batatas* for this purpose and that De Vries [4] repeated Duchartre's experiments, both agreeing that there was neither circumnutation nor twisting except under the immediate or deferred influence of light.

As neither of these papers, nor any other available literature in the same field, showed any reason for a relation between nutation and illumination, and as a supply of roots of various varieties of *Dioscorea* was on hand at the moment, I had a series of these roots placed where they might germinate. For this initial work,

[1] Jahrbüch. f. Wissenschaf. Bot. 56: (1915).
[2] Ibid., p. 511.
[3] Expériences relatives á l'influence de la lumiére sur l'enroulement des tiges. *Comp. Rend. Acad. Sc. Paris* 61 (1865) 1142.
[4] Zur Mechanik der Bewegungen von Schlingpflanzen. *Arbeit. Bot. Inst. Würzburg* 1 (1873) 327.

I am indebted to my assistant, Mr. R. B. Espino. Of each of thirteen varieties, and working with a single pure strain in each case, ten roots were placed in darkness on a concrete floor, three in darkness in moderately moist soil, ten in the plant-physiology laboratory on a wooden table beside the windows, and three in the latter place, but in bamboo tubes of soil. The names and numbers of the plants used for these observations are given in Table I.

TABLE I.—*Names and numbers of plants of Dioscorea used in the experiments.*

College No.	Botanical name.	Vernacular name.
88	*D. aculeata* var. *tiliaefolia*	Tugui.
329	*D. alata*	Binaksan ube.
331	*D. hirsuta*	Calut or nami.
938	*D. alata*	Ube.
952	do	Lagkitang-morado.
956	do	Tumque.
958	do	Sinanto.
959	do	Kinahoy na pula.
960	do	Dinaliri.
1094	do	Ube inanislog.
1101	*D. aculeata*	Apari or tugui baliran.
1369	*D. alata*	Ubeng ligao.

For darkness, the photographic dark room was used, since it was at that time, April, needed for no other purpose. The dark room and the plant-physiology laboratory are in the same building. Occasional observations showed the temperature to be the same in the two rooms, and there was no evident difference in humidity during the early part of the experiment. During the latter part of the experiment, the soil in the dark room was not kept moist, so that the air there was drier than previously, while in the laboratory, the air became more humid as the rainy season came on. Therefore, growth during the latter part of the period of observation is not available for a judgment as to the effect of light and darkness on the rate of growth.

With some interruptions, daily growth measurements were made from April 25 to May 26. In presenting statistics of this kind, the use of averages has become usual and one is tempted to present them. With one hundred fifty-six plants in light and an equal number in darkness, it would have seemed that I was working with sufficient material to justify the use of averages.

However, while the behavior of the different plants from the time that a sprout became active until its growth ceased, or at least slackened, had so much in common that in a general way it can be described as uniform in its larger features, there was such irregularity in the time at which this occurred that the difference, which would appear at any time between average growth in darkness and average growth in light, would have been an expression of the number of plants that happened just then to be active, rather than of a difference in growth under the influence of the illumination. Some plants started, reached their maximum rate, and nearly or quite ceased to grow; while others remained quite inactive, but retained their power of growth, as proved by subsequent behavior.

Tables II and III shown the growth in millimeters, for one day, May 8–9 and for one week, May 9–16, respectively, for each of the plants. The exceeding irregularity is seen at the first glance. While these tables contain many blanks, indicating that the plants in question had not begun to grow, there were very few of the entire lot of roots that did not grow before the experiment was discontinued, about the end of June.

There was no rule as to which plants would grow first, except, perhaps, that a large tuber was likely to germinate earlier than a small one; even to this rule, there were so many exceptions that it would not be worth while to pair the tubers by size and to expect them to be comparable in rate of growth at any particular time. Some varieties on the average germinated sooner in darkness and others in light. On the whole, germination of the plants in soil was quicker in darkness than in light. This was possibly due to the soil having been kept wetter in the dark room; but there was no intention to do this. In the light the plants of more than half of the varieties germinated more slowly in the bamboo tubes than on the open table. In spite of this, my conclusion from observation of the whole series is that germination can be hastened somewhat by moisture, but is independent of illumination.

In spite of the diversity of figures in Tables II and III and of the further fact that this diversity would be the same if any other days or weeks were chosen for presentation, I believe that one may conclude from all of the figures that the rate of growth of young shoots of *Dioscorea* is independent of the light. Pfeffer, probably on Sachs's authority, says that this is the case. The average growth of all cultures, as has already been noted, was

greater in the light. But, as also previously suggested, I suspect that this was due to the atmospheric moisture. The average growth of reasonably active plants was usually greater in light than in darkness. Such an average is meaningless, unless the plants compared are at the same stage of the grand period of growth of the shoot being tested; but, if such averages are greater on the one side consistently, day after day, outside conditions may be regarded as responsible. However, there were constantly conspicuous exceptions to this rule, there being at all times from one-third to one-half of the varieties of which the most rapidly growing single plant was in the dark.

TABLE II.—*Growth of tubers of Dioscorea during one day, May 9–10.*

College No.	Illumination.	Growth in millimeters.												
		Without soil. Tuber No.—										In soil. Tuber No.—		
		1	2	3	4	5	6	7	8	9	10	1	2	3
962	Dark					6					6	19	7	4
	Light	11		1		6				2	3			
1369	Dark	12			4		2	7					5	
	Light													
958	Dark	14			8	6				10				
	Light				1		2							
960	Dark	3	5	1	3	4	7	10				40	7	16
	Light		12	33	1	5	31	9	17	4	4			62
331	Dark	9			16		70							26
	Light	5		4	70	157	5	135	4	4	34			
951	Dark	2	5						2	2		12		6
	Light				26	1		6	3					4
88	Dark	13	3	26	10	23	25	2	2		24	39	76	
	Light	116	18	4	159	97	127	26	91	6		91	121	
956	Dark			2			4	2	2		4		61	
	Light	4	1						1					
1101	Dark	9	11	11	2	31	41	5				14	54	71
	Light			120					3	31	3		5	5
329	Dark			7					1	2		32	7	19
	Light	5	13	5	3		18	5	6			5		16
1094	Dark			7				7			1			
	Light	2		12		2				3				
938	Dark								10				7	
	Light	3					1						1	

TABLE III.—*Growth of tubers of Dioscorea during one week, May 9–16.*

College No.	Illumination.	Growth in millimeters.												
		Without soil. Tuber No.—										In soil. Tuber No.—		
		1	2	3	4	5	6	7	8	9	10	1	2	3
952	Dark	8	14	-----	2	58	3	-----	-----	-----	-----	77	64	111
	Light	70	-----	38	-----	12	-----	-----	-----	9	-----	15	16	-----
1369	Dark	-----	-----	-----	5	-----	48	4	27	14	-----	-----	25	-----
	Light	-----	-----	-----	-----	-----	-----	-----	15	-----	-----	-----	-----	-----
958	Dark	32	-----	9	9	58	9	-----	-----	28	-----	-----	40	-----
	Light	-----	-----	-----	17	-----	9	-----	6	-----	-----	-----	-----	20
960	Dark	35	65	2	19	33	52	40	-----	-----	-----	519	191	-----
	Light	-----	115	329	15	121	246	86	137	57	42	42	-----	288
331	Dark	109	-----	-----	309	-----	70	-----	-----	-----	-----	749	-----	419
	Light	15	-----	156	701	580	64	717	8	13	306	-----	-----	-----
959	Dark	17	43	-----	-----	-----	9	-----	2	-----	-----	25	50	85
	Light	-----	-----	5	185	7	-----	19	8	5	-----	34	-----	44
88	Dark	73	29	208	21	312	324	52	11	-----	282	286	993	-----
	Light	489	74	6	769	320	788	399	338	470	-----	743	423	10
956	Dark	-----	-----	3	-----	-----	21	22	8	-----	11	6	906	8
	Light	9	3	-----	-----	-----	-----	-----	-----	-----	-----	14	-----	-----
1101	Dark	160	161	168	16	218	330	79	-----	-----	-----	244	262	344
	Light	-----	-----	634	116	14	-----	-----	103	614	61	23	122	149
329	Dark	-----	34	42	-----	37	-----	40	1	5	1	171	50	84
	Light	68	124	17	10	9	159	82	64	-----	-----	71	-----	159
1094	Dark	-----	-----	61	21	-----	-----	46	-----	-----	1	20	84	23
	Light	9	-----	69	-----	7	14	6	16	19	-----	-----	-----	8
938	Dark	10	16	-----	10	7	-----	-----	86	-----	-----	-----	140	10
	Light	24	-----	17	-----	20	1	-----	-----	-----	-----	35	9	-----

During the whole period of experiment, the plants exposed to light reached a decidedly greater average length, as is shown by Table IV.

TABLE IV.—*Length of longest shoot and average of most active plants.*

College No.	In light.		In darkness.	
	Longest.	Average.	Longest.	Average.
	mm.	mm.	mm.	mm.
88	3,860	3,457	1,690	1,321
329	1,967	1,324	860	534
331	4,780	2,540	1,990	1,695
938	2,235	792	1,052	672
952	722	495	592	430
956	865	790	2,844	924
958	2,591	1,454	919	678
959	2,540	1,455	448	-----
960	2,718	1,371	2,150	1,160
1094	1,107	963	421	375
1101	2,661	2,010	875	-----
1369	1,900	1,342	1,130	945

The chief reason for this very considerable difference is not the rate of growth of active plants, but is rather the fact, that after the middle of the time of experiment there was a decided tendency for the plants in darkness to die at the tips. This was perhaps due to the dry atmosphere, perhaps to darkness itself. The death of the tip was usually followed by the appearance of branches. The plants in darkness had usually several axes, either by the branching of the shoot, or by the production of a number of successive shoots from the root; while in light, the plants of most varieties produced a single shoot, which did not branch during the period of the experiment. What would obviously be expected, was true—the plants with one shoot reached a greater length than did equally thrifty plants with several shoots of which only one was measured.

The possibility has just been suggested that the darkness is itself responsible for the blasting of the young tips and their replacement by branches. In the course of the experiment, it happened to nearly all of the plants, which were first to germinate and grow vigorously, that the vigorous shoots gradually grew less rapidly and presently ceased to grow altogether. This happened sooner in darkness, but eventually to many of the plants growing in light. My first impression in the case of the plants in light, which in several cases reached a length of nearly, or quite, two meters before growth ceased, was that the store of food was becoming exhausted or that the distance to which food might be transported from the root to support activity at the growing point had been reached or exceeded. However, it presently developed, that in every case of this kind one or more branches developed soon after the cessation of growth of the first tip and that at least one of these branches grew as actively as the main shoot had previously done and presently exceeded the main shoot in length. The experiment was continued long enough so that some of these branches in their turn ceased to grow in the same manner and were likewise outgrown by other branches. The total length from root to tip of branch was in a number of cases more than twice that of the main shoot.

The plants in the laboratory, although spoken of as exposed to light, were not illuminated as plants are likely to be in nature. It occurs to me, that with anything less than normal illumination it may be natural for the tip of any one stem or branch to cease to grow after a time, unless it comes under conditions quite favorable to development as a permanent main axis of the plant. Under these conditions, the attempt is made next with a branch which at first, at least, follows a different course from the parent

shoot and so tests the possibility of growing into thoroughly favorable conditions, following a different line. If this be the explanation, the dying of the tips in darkness may be a more pronounced expression of the same power of the plant to test out a succession of possible lines of growth, instead of consuming its whole food store in an attempt to reach the light with a single attempt. I have observed that branches of *Dioscorea luzonica*, growing beside my house, reach a limited length and stop rather abruptly under the eaves, but continue to grow much longer and develop as vegetative shoots, if they happen to grow outside the eaves.

Direct, but not very careful, observation seemed to show that the plants in the laboratory grew as fast during the day as during the night or somewhat faster during the day. Doctor McLean kindly checked this observation by the use of the auxanometer with one of the healthy plants of *Dioscorea hirsuta*, No. 331. The results of this test, from 9 o'clock in the morning, May 30, to 9 o'clock in the morning, May 31, with the thermograph reading at the same hours, are shown in Table V.

TABLE V.—*Hourly growth of a healthy plant of Dioscorea hirsuta, No. 331, during twenty-four hours.*

Time.	Growth.	Temperature.	Time.	Growth.	Temperature.
a. m.	*mm.*	°*C.*	p. m.	*mm.*	°*C.*
9		27	9	6.8	27.8
10	6.8	27.6	10	8.7	27.0
11	8.8	28.5	11	7.8	26.3
m.			12	7.5	25.8
12	8.9	29.5	a. m.		
p. m.			1	6.5	25.5
1	9.1	30.1	2	7.3	25.2
2	8.4	30.8	3	7.0	25.0
3	10.1	31.0	4	6.0	24.9
4	11.3	31.1	5	5.8	24.7
5	11.6	31.1	6	6.6	24.7
6	11.5	30.6	7	6.3	25.9
7	9.5	29.8	8	5.9	26.7
8	9.2	28.6	9	6.4	26.9

The growth of this plant during the daylight hours was conspicuously more rapid than during the night, but the distribution of growth is very evidently much more closely correlated with the temperature than with the illumination, which was stronger during the forenoon than in the afternoon. The slowest growth recorded for any hour was from 7 to 8 in the morning, while the

illumination was not much less than at midday, but the temperature was 4° or 5° lower. This experiment substantiates the opinion previously reached that illumination in itself is practically without direct influence on the rate of growth; but the same experiment demonstrates that temperature has great influence on growth, and suggests that an increase of 5°, say a change from 26° to 31°, is sufficient almost to double the growth rate.

A considerable number of measurements of growth by centimeter zones were made in light and in darkness, using in all cases plants which were among the most rapid in their growth. The general result was that the plants in light had a considerably longer growing region, and that the region of most rapid growth was farther from the apex. A few illustrations will suffice to make this clear.

TABLE VI.—*Growth in millimeters of centimeter zones.*

Centimeter zone.	May 18–19. College No. 88.		May 9–10. College No. 88.		May 9–10. College No. 331.		May 18–19. College No. 960.	
	In light. Dry 9.	In darkness. Soil 2.	In light. Dry 1.	In darkness. Soil 3.	In light. Dry 5.	In darkness. Soil 1.	In light. Soil 6.	In darkness. Soil 2.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1	5	8	3	7	3.5	5	3	
2	8	14	10	14	5.5	7	*	3
3	7	17	10	16	10	9	2	13
4	4.5	20	12	8	10	16	2	3.5
5	4	16	10	3	11	19	2	2
6	4	13	9	0.5	12	17	2	0.5
7	3.5	12	7	0.5	12.5	10	2	
8	4.5	9	4		10	9	2	
9	3	8	4		10.5	8	1.5	
10	2.5	7	3		10	5	1.5	
11	2.5	4.5	4		10	3.5	1	
12	3	3	3.5		8	1.5	1	
13	2	2	3		8	1.5	1	
14	1.5	2	2.5		7	1	0.5	
15	1.5	1	3		6		0.5	
16	1	0.5	3		4.5			
17	1		3		4.5			
18	1		2.5		4			
19	1		3		3			
20	0.5		2.5		3			
21	0.5		3		2			
22	0.5		2		1.5			
23	0.5		2		0.5			
24	0.5		2					
25			2					
26			1					
27			1					
28								

In all of the pairs of plants tested, it happened only once that the plant in darkness showed a longer growing region than that in light; in this case, the plant in light proved to have a surprisingly short growing region. It happened repeatedly in the course of these observations of paired plants that the plant in darkness showed greater total growth than the plant in light and yet showed a much shorter growing region, in some cases less than half as long.

We have here, I believe, the whole of the immediate explanation of the conclusion of Professor Newcombe:[5]

> Die ummittelbare Ursache des Verlustes des Windens ist der Verlust des einseitigen Wachstums im Stamme eine beträchtliche Entfernung rückwärts von der Spitze—bei den meisen der beobachteten Pflanzen mehrere Zentimeter rückwärts von der Spitze.

It is not merely that this zone on the stem loses the faculty of one-sided growth; the region that would execute the circumnutating movement in light almost *ceases to grow at all* in darkness or does actually cease entirely to elongate. In Pfeffer's Physiology, volume II, page 13, I find the citation of a paper by Strehl said to show that the elongating region is longer in etiolated than in normal stems. I have been unable to check this by reference to the original publication, which is a Leipzig doctor's thesis of 1874. Without testing at all a variety of stems, I strongly suspect that the condition I have found in *Dioscorea* will turn out to be quite general. On the one hand, it can be harmonized easily with my old observation,[6] that the turgor of etiolated stems is less than that of normal stems. The lower turgor in the zones which lie beneath that of rapid growth may well be associated with a cessation of growth prompter than would occur if the turgor were higher.

On the other hand, the short elongating region of stems in darkness invites biological interpretation. It is an old and, I believe, generally accepted idea that the rapid elongation of etiolated or etiolating stems is a response to darkness that has been selected and fixed and is, therefore, inherited, because this rapid growth is likely, in nature, to result in the shoots' reaching light sooner than they would do at the normal rate of growth or in reaching light from positions where the normal rate and manner of growth would result in exhaustion before light could be reached. The typical phenomena of etiolation are best shown

[5] Op. cit., p. 523.

[6] Ueber den Einfluss von Licht und Temperatur auf den Turgor. Halle (1895).

by seedlings, and in this work with *Dioscorea* I am working with stems analogous to the primary stems of seedling plants. The primary stem of seedlings most frequently finds itself in darkness because buried by the soil; rapid growth is nature's method of bringing the shoot to the light before the exhaustion of its food store. If etiolation is an adaptive phenomenon, selected primarily because it preserved plants that germinated below the surface of the ground and enabled the growing point to reach and pass the surface, then a short growing region is just as natural a feature of this phenomenon as is rapid growth in length. The short growing region of the etiolated stem is explained then in a biological sense just as is the relatively short growing region of roots. A structure elongating where mechanical resistance is likely to be encountered has need to be short, as compared with the growing region of other structures, which elongate in the atmosphere and normally have no outside mechanical resistance to overcome.

I have made no experiments with the change in length of growing region and manner of growth, when plants are taken from the light to the dark room. When plants are brought from the dark room and exposed to the light, the growing region becomes longer. This lengthening of the elongating region (if I may use the same word twice together in different senses) consists in the retention of the power to elongate on the part of the zones that in darkness would cease to grow in length. This is easily tested by measuring the same zones for successive days. Under constant external and internal conditions, the length of the zones that cease to elongate during any day is naturally approximately equal to the increase in length on the same day. If a plant be brought from the dark room into the open laboratory, it may happen that no zone ceases to grow during the next day or even two days; and in any case, the length of the region that ceases to grow is much less than the daily increment. Thus, in the case of *Dioscorea hirsuta*, May 23, plant No. 3 on the floor of the dark room was brought into the open laboratory. During the following day, it grew 6.8 centimeters and the region which ceased to grow was only 2.25 centimeters long. The increase in length of the elongating region continues until the normal length for a plant growing at the same rate in light is reached. This seems likely to be accomplished in about three days.

The remeasurement of zones on successive days is a valuable test of the accuracy of one's measurements and observations by these methods. It has just been suggested that if on successive days measurements are made of the distance between the same

marks, growth should cease each day at the back end of the growing region, in zones having a total length about equal to the day's total growth. I noticed years ago, that published figures by as careful a worker as Sachs do not stand this test, but that, if one might judge from the figures, the total elongating region is much longer on the second day than it was on the first. Since noticing this, I have always made it my practice to check measurements occasionally by remeasurement after a second day. This kind of check is illustrated by the measurements on plant "Light Soil No. 1," *Dioscorea hirsuta* No. 331, May 23–25, shown in Table VII.

TABLE VII.—*Growth of the same zones on successive days.*

[*Dioscorea hirsuta*, Light Soil No. 1, May 23–25.]

Centimeter zone.	Growth, first day.	Growth, two days.	Centimeter zone.	Growth, first day.	Growth, two days.
	mm.	*mm.*		*mm.*	*mm.*
1	5		14	6	6
2	8		15	5	5
3	12		16	4	
4	12		17	3	
5	14		18	2.5	13.5
6	15		19	2	2
7	19	34	20	2	
8	19	26	21	1.5	
9	15	17	22	1	
10	14	15	23	0.5	
11	12	13	24	0.5	
12	9	9	25	0.5	
13	8	8	26		

Analyzing these figures, it appears that the growing region the first day was 25 centimeters long. At the end of the second day, zone 11 extended 25.4 centimeters from the apex, and was the last zone that showed any increase in length. In other words, the figures checked in this case and the length of the growing region was unchanged.

Many of the plants in darkness had a short apical portion rather sharply bent. This was usually not more than 1.5 centimeters in length. Repeated observation showed that the movement of these apical segments was quite irregular, which agrees with Newcombe's observations. The most remarkable behavior shown was that of occasional plants that kept the bent part at nearly the same angle and in the same direction, while the stem as a whole was growing. The movement of this apical part resulted sometimes in a twisting of the stem and at the other times did not do so. *Dioscorea alata* is a remarkably convenient subject for the observation of twisting.

While the growth farther from the apex, which would have produced nutation and twining, ceased in most plants in darkness, the length of growing region and the activity of zones somewhat remote from the apex did not change uniformly. If this region was especially active, nutation was possible very much as in light. In a number of stems in darkness, always especially vigorous specimens, there was an unmistakable movement, apparently in the distinctive form of normal nutation; and in a single case, *Dioscorea aculeata* No. 88, dark soil No. 3, the main stem being broken and replaced by a very vigorous branch, the latter, during the three days preceding May 16, wound three times around a stick of wood in a perfectly regular spiral.

Growth is a complicated process. Defined as a change in form or size, it of course includes metabolic processes that find no expression in the definition. Environmental conditions that find an expression in growth may do so in a variety of ways, which have hitherto escaped adequate analysis. Aside from metabolism taking place in the region or structure that actually grows, the growth of higher plants is dependent in all cases upon changes taking place elsewhere in the plants. In the case of the yams, the growth of the distal part of the growing shoot depends upon the metabolic processes taking place in the food store, by which the food is made available for removal, and upon the translocation of this food from the place of storage to the place of use.

It has already been indicated that the rate of growth varies with the temperature. Aside from the effect of temperature exerted directly on the growing region, which effect may itself be subject to analysis, temperature may have an influence upon the preparation of the food for translocation or on the rate of translocation itself. For the analysis of the problem into three phases—metabolic processes in the food store, translocation, and processes in the growing region itself—*Dioscorea* is an especially suitable subject for study. The experiments that I have made along this line are no more than introductory. However, the question is an important one, and the methods are believed to be worthy of general use. For these reasons, the tentative and inclusive experiments already made are reported here.

The investigation of the influence of temperature on the processes taking place in the food store was made by the very simple and obvious device of inserting a part of the tubers in ice water, and comparing the growth of the corresponding shoots with that of the shoots of plants, the whole of which were kept under ordinary laboratory conditions. The results of this experiment are recorded in Table VIII, showing the growth of plants of

Dioscorea hirsuta No. 331, of which 6*a*, 6*b*, 9, and 10 had the tubers in ice water, while the remaining plants were not so treated. The second horizontal line of growth figures shows the growth from May 26 at 5 o'clock in the afternoon to May 28 at 10 o'clock in the morning at which hour the ice water was applied. The remaining figures indicate the growth in millimeters during the preceding time-interval.

TABLE VIII.—*Effect of cold on tubers of Dioscorea hirsuta No. 331.*

[Measurements are recorded in centimeters.]

	Growth of stem. Tuber No.—												
	2*a*	2*b*	3	4*a*	4*b*	5	6*a*[a]	6*b*[a]	6*c*	7	8	9[a]	10[a]
Length of shoot, May 23	47	34	92	129.6	82.3	87.1	71.9	68.8	28.9	40.5	54.9	70.2	50
Growth, from May 26 at 5 p. m. to May 28 at 10 a. m.	14.0	12.0	25.6	17.2	14.7	27.9	15.4	15.2	3.5	13.8	23.8	28.1	12.6
Additional growth:													
May 28, at 11.40 a. m.	1.0	0.7	1.5	1.1	1.0	0.8	0.6	0.4	0.1	0.9	1.3	1.0	0.3
May 28, at 1.40 p. m.	1.2	1.0	1.4	0.7	0.9	1.4	0.5	0.5	0.4	1.3	1.2	0.5	0.3
May 28, at 3.40 p. m.	1.1	1.0	1.4	0.7	1.0	1.0	0.4	0.4	0.1	1.0	1.4	0.6	0.3
May 28, at 5.40 p. m.	1.1	0.9	1.4	0.5	0.5	1.1	0.2	0.0	0.2	1.1	1.1	0.3	0.0
May 28, at 7.40 p. m.	0.9	0.9	1.0	0.3	0.6	1.0	0.2	0.1	0.2	0.8	1.1	0.2	0.1
May 29, at 7.40 a. m.	4.8	3.2	3.3	2.0	2.6	5.6	0.2	0.3	0.0	5.3	4.6	0.4	(b)
May 30, at 7.40 a. m.	14.3	11.1	16.1	9.7	10.2	16.2	0.4	0.5	0.1	-----	13.9	0.6	------
May 31, at 5 p. m.	22.6	18.7	24.1	18.3	16.8	21.3	6.0	8.4	0.3	-----	25.0	5.9	------
June 6, at 11 a. m.	70.4	80.7	83.4	62.9	40.2	48.9	54.1	79.9	28.1	-----	81.2	62.0	------

[a] Tubers in ice water. [b] Injured.

As Table VIII shows, the effect of chilling the food store was shown with considerable promptness in the rate of growth, even when the growth was occurring at a distance of more than 1 meter. The figures near the bottom of the table show that, after the food stores were permitted to become warm, there was a prolonged after-effect of the chilling. However, this cannot have been due to any permanent injury, such as killing the food stores or many of their cells, for the ultimate growth was at about the same rate in all of the plants; and it occurred at about the same rate, whether or not the roots were immersed in water.

To test the effect of cold upon the rate of translocation, double glass tubes, 20 centimeters in length, were prepared, the inner tube containing the stem and being so small that the stem nearly filled it, and the outer tube carrying a stream of water which ran from a can containing ice. As I set the experiment up, it was impossible to lower to below 8° the temperature of the water leaving the outer tube. The temperature in the inner tube was

practically the same. At this temperature, there was no considerable checking of the rate of growth. When I succeeded in keeping the temperature constantly at 8°, growth seemed to be influenced slightly, but when it rose to 16°, growth was not appreciably different from that of the control stems at a temperature throughout of, say, 26°. Better arrangement of the experiment would of course effect temperature down nearly to the freezing point. To do this temporarily, I disjointed the outer tubes and fill them with shaved ice, and kept this up, renewing the ice constantly, for a period of two hours. The effect of this was to check the growth quite appreciably, and this effect continued, and finds expression in the growth during the twelve hours from 7.30 at night, May 28, to 7.30 the following morning. During the ensuing twenty-four hours, the plants which had been subject to local chilling grew faster than the control plants, which may be construed as merely showing that the effect of the treatment had been completely overcome. Details of this experiment are shown in Table IX.

TABLE IX.—*Effect of cold on stems of Dioscorea hirsuta.*

[Measurements of growth are recorded in centimeters.]

Date.	Tuber No.—				Remarks.
	1	6*a*	6*b*	9	
May 25–26	18.0	14.1	12.5	14.1	
May 26–27	20.6	13.2	14.6	14.9	
May 27, 5 p. m., to May 28, 9 a. m.	6.7	4.9	6.6	5.9	Cold water turned through 6*b* and 9; temperature at 9.20 a. m., 6° C.
May 28:					
9 a. m	[a]161.0	[a]164.2	[a]123.2	[a]134.0	
11.30 a. m	1.7	0.6	1.5	1.3	Room temperature at 10.30 a. m., 26° C. Water slowed at 12 m., temperature then, 8°.
1.30 p. m	0.9	0.7	1.4	1.0	Temperature at 1 p. m: Room, 28°; 6*b*, 16°; 9, 19°.
3.30 p. m	1.3	0.8	0.7	0.9	Temperature at 3 p. m.: Room, 27°; 6*b* and 9, 8°. At 3.15 flow was checked in 9, temperature, 16°; corrected, dropped to 8°.
5.30 p. m	1.3	0.7	0.8	1.0	Temperature at 4.20: Room, 28°; 6*b* and 9 (outflow), 8°.
7.30 p. m	0.9	0.3	0.3	0.6	Shaved ice put in place of cold water, 5.30 to 7.30; temperature then about 3°. Room temperature at 7.30 was 27.5°.
May 29, 7.30 a. m	4.6	2.3	1.1	2.1	
May 30, 7.30 a. m	8.9	8.1	10.6	11.5	
May 31, 5 p. m	8.6	7.7	15.3	8.1	
June 6, 10 a. m	31.6	21.9	65.3	46.8	

[a] Total length at 9 a. m., May 28.

SUMMARY

1. Previous observations, that a nutation of shoots of *Dioscorea* ceases in darkness, are in general correct.

2. Especially active stems may nutate and twine around a support in darkness.

3. Professor Newcombe's observation that the failure to twine in darkness is due to changes a number of centimeters from the apex is correct.

4. The rate of growth of vigorous young shoots is but slightly, if at all, influenced by the illumination.

5. The elongating region is much shorter in darkness than in light. The part of the stem which executes the movements, in active nutation in light, almost, or quite, ceases to elongate in darkness, and it is for this reason, that twining ceases in darkness.

6. The short elongating region in etiolated shoots may be explained biologically as a selected adaptation to the condition under which young shoots in nature are most likely to find themselves in darkness—this is, in the soil, where a long growing region would be just as dangerous as the production of ample leaves.

7. The growing shoots of *Dioscorea* are excellent material for the analysis of the influence of temperature or other external conditions upon growth, into:

A, effect on the growing region;
B, effect on the metabolic processes, which make food available; and
C, translocation of food to the growing region.
Low temperatures, applied either to the food store, or to the stem through which the food must pass to the growing region, result in prompt checking of growth.

8. It is suggested that the blasting of the growing point and its replacement by a branch, which at first grows at a right angle to the axis from which it springs, is a selected phenomenon, by which the plant, the shoot of which is under unfavorable conditions, tests a wholly different line, instead of using itself up in one attempt to reach a place where conditions are good.

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RELIQUIAE ROBINSONIANAE

By E. D. MERRILL[1]
(From the Botanical Section of the Biological Laboratory, Bureau of Science, Manila, P. I.)

A critical investigation of Rumphius's[2] "Herbarium Amboinense," a pre-Linnean publication of preëminent importance and one of the classical works on Malayan botany, shows that about three hundred fifty binomials have been based wholly on its descriptions and figures since the establishment of the binomial system in 1753. As Rumphius's descriptions, while often ample, are non-technical; as the figures are not infrequently crude; as the arrangement of his material follows no definite system of classification; and as there is no extant botanical material representing the plants that he described and figured, the matter of properly interpreting numerous species that are typified by his descriptions and figures is a very complicated one, and is a subject that has not been given the attention that it warrants by modern botanists.

In organizing the botanical work for the Philippine Government I was confronted with a similar problem in connection with the proper interpretation of the numerous species described by Blanco in his "Flora de Filipinas,"[3] species, like those based on Rumphius's work, that are not represented by extant botanical material. Field work in the Philippines with special reference to the data assigned by Blanco to the various species has enabled me definitely to determine the status of a very high percentage of them.

In the Philippines, as in all other parts of the Indo-Malayan region, the systematic botanist is very frequently confronted with the problem of interpreting species based on forms figured and described by Rumphius. As the work on the Philippine

[1] Associate professor of botany, University of the Philippines.

[2] Rumpf, G. E. Herbarium Amboinense, plurimas complectens arbores, frutices, herbas, plantas terrestres et aquaticas, quae in Amboina et adjacentibus pereriuntur insulis, adcuratissime descriptas juxa earum formas cum diversis denominationibus, cultura, usu ac virtutibus, etc. Amsterdam, volumes 1 to 7 (Auctuarium) 1741–55.

[3] Blanco M. Flora de Filipinas (1837) LXXVIII+1–887; ed. 2 (1845) LXIX+1–619; ed. 3, 1-4 (1876–83).

flora progressed, it became increasingly evident that, in order to establish a stable basis of nomenclature for numerous Philippine species, a botanical exploration of Amboina was urgently needed. Plans for this proposed work were prepared in the latter part of 1912 and the early part of 1913, and the actual work of the botanical exploration of Amboina was assigned to the late Dr. C. B. Robinson, at that time assistant botanist in the Bureau of Science. Doctor Robinson left Manila on June 17, 1913, and proceeded to Amboina via Buitenzorg, Java. He arrived in Amboina July 15, 1913, and actively prosecuted his field work there until the day of his untimely death, December 5, 1913. On this day, while on a botanical trip, unaccompanied, he was murdered by some Boetonese men who had established a small settlement between Aerlo and Seri, about fifteen kilometers from the town of Amboina. An investigation of the case by the local authorities has definitely shown that Doctor Robinson's death was wholly due to a local superstition.[4]

During the time that Doctor Robinson was in Amboina, and including a few species that he secured, enroute, at Boeleleng, Bali; Baoe-baoe, Beoteon; and Macassar, Celebes, he collected approximately 1,750 numbers of plants, most of the numbers being represented by abundant duplicate material. The collections were approximately arranged in two groups by Doctor Robinson, during his stay in Amboina; first, those that could definitely or fairly definitely be referred to species described by Rumphius; and, second, those species that were not described by Rumphius. Of the first group there are approximately 600 numbers, and these have been arranged in a special series, *Plantae Rumphianae Amboinenses,* and will be distributed with special labels giving both the modern binomial and the Rumphian name and reference for each species. This material has been utilized in the preparation of a special report in an attempt to interpret the species described in the Herbarium Amboinense, now practically completed. The material arranged in the second group, *Reliquiae Robinsonianae,* that is, those species not described by Rumphius, is the basis of the present paper.

As the work in Amboina was originally planned, it was our intention that Doctor Robinson should remain in the field for a period of about five months. As the work progressed, it became evident to him that he could not hope to solve any where near all the problems presented by the identification of the Rumphian

[4] Merrill, E. D. Charles Budd Robinson, Jr. *Philip. Journ. Sci.* 9 (1914) *Bot.* 191–197.

species, and on the basis of data supplied by him, arrangments were made to extend his time in Amboina until the first of June, 1914, thus giving him nearly a year in the field. The work he actually accomplished in his four and one-half months in Amboina has been of inestimable value in determining the status of the numerous Rumphian species, but his collections would have been far more valuable had he been spared to complete his task.

It was no part of my plan to work this Amboina material, for the final reports were to have been prepared for publication by Doctor Robinson. However, owing to the unforeseen and unfortunate ending of the Amboina exploration it has devolved upon me to complete the work that was made possible by the material and data secured by Doctor Robinson.

The present contribution is not, and from its very nature cannot be considered, more than a mere contribution to our knowledge of the flora of Amboina. None of the numerous species described and figured by Rumphius are included. However, under the circumstances associated with the untimely death of Doctor Robinson, it has been deemed expedient to compile an enumeration of the miscellaneous material included in his collections. While the enumeration is practically complete for higher plants represented in the *Reliquiae Robinsonianae* series, this statement does not hold true for the cellular cryptogams. In the *Reliquiae Robinsonianae* series there are 1,142 numbers—nearly twice as many as in the *Plantae Rumphianae Amboinenses*. About 217 of these are fungi; 72 are mosses; 54, hepatics; and 14, algae. Owing to the unsettled conditions brought about by the present war, it has not been possible to include in the present paper more than an enumeration of the lichens among the cellular cryptogams. The manuscript report on the mosses, prepared by Doctor Brotherus, of Helsingfors, Finland, has been lost or destroyed in transit; the hepatics have not been submitted to any specialist; the algae still remain unidentified; while the report on the fungi, which were placed in the hands of Doctor Sydow only after many difficulties had been overcome, and then only after the third attempt, has been retained either for publication in Europe or for transmission when conditions shall have again become normal. Likewise, in the present paper, the *Pteridophytes* have not been included, as these plants have already been enumerated by Captain C. R. W. K. van Alderwerelt van Rosenburgh.[5] Reports on the *Orchidaceae*

[5] The Amboina Pteridophyta collected by C. B. Robinson. *Philip. Journ. Sci.* 11 (1916) *Bot.* 101–123, *t. 5, 6.*

and on the *Rubiaceae* are not available for publication at the present time. All the material of the *Orchidaceae* is in the hands of Doctor J. J. Smith, and of the *Rubiaceae* is in the hands of Dr. Th. Valeton for study.

In the present enumeration the vast majority of the species included are those already described by the other authors. The percentage of novelties in the collection is small, as was to be expected from a small island that has been visited by so many botanists as Amboina, for Amboina is classical ground in Malayan botany. The work of most botanists and collectors in Amboina, however, has been confined for the most part to visits of from a few days to a few weeks, and it is apparent that a considerable amount of Amboinan botanical material still remains in various herbaria unidentified. A few new species have been proposed; namely, about twenty-three by myself in various groups, two species of *Piper* by M. C. de Candolle, and three species of lichens by Mr. G. K. Merrill. The collection has supplied material by which the status of several of Roxburgh's species, based on material originating in Amboina or in the Moluccas, and which were very imperfectly described, can definitely be determined, quite apart from the value of the specimens placed in the other series, *Plantae Rumphianae Amboinenses,* in determining the status of the very numerous species based on Rumphius's descriptions and figures.

Like many other parts of the Malay Archipelago, the vegetation of Amboina has been much changed since the time that Rumphius wrote his Herbarium Amboinense. It is evident that the forests were then much more extensive than they are to-day. As the population has increased, the virgin forest has been destroyed to make way for cultivated lands, and it is very probable that in Amboina, as certainly in the more densely populated Island of Java, species more or less common in Rumphius's time, have since been exterminated or at least have become very rare and local. The virgin forest supports a type of vegetation entirely different from that of the settled areas and the second-growth forests, and as a rule, this type of forest, when once destroyed in the Malayan region, is never replaced by the same type of vegetation, or if replaced, the original species grow again only after the lapse of many years.

As the present contribution is by no means a study of the flora of Amboina as a whole, it is hardly the place to discuss the characteristics or the relationships of the flora. It is very probable that eventually the island will present a very small endemic

flora, yet at the present time a fairly high percentage of species enumerated are known only from Amboina. Due to the proximity of other islands, and to the backward state of our knowledge of the flora of the Moluccas as a group, it is only reasonable to expect that an intensive exploration of the neighboring islands will yield most of the species that are now known only from Amboina.

The flora is, of course, a typical Malayan one. It contains some Australian types, but most of these are rare or at the best are nowhere dominant, quite as similar Australian types are found in the Philippines. Among these may be included *Flindersia, Eucalyptus, Stackhousia, Schizomeria,* and, perhaps, representatives of a few other genera. Like other parts of the Moluccas, Celebes, and New Guinea, the Amboina flora presents a striking similarity to that of the Philippines, not only in its species, but also in its genera. In one of Doctor Robinson's letters, he mentions the fact that so far as the general type of the vegetation was concerned, and for that matter most of the genera and very many of the species encountered, he might as well be in the Philippines as in Amboina. In the course of the study of this material a number of species have been detected that were previously reported only from the Philippines, among these being *Thoracostachyum lucbanense* Kükenth., *Abelmoschus mindanaensis* Warb., *Gyrinopsis brachyantha* Merr., *Dysoxylum euphlebium* Merr., *Polypodium merrillii* Copel., *Litsea perrottetii* F.-Vill., *Hypoestes laxiflora* Nees, *Pratia ovata* Elm., *Erycibe lateriflora* Elm., and *Aglaia multifoliola* Merr. The Amboina species *Callicarpa pentandra* Roxb. proves to be indentical with *Geunsia hookeri* Merr., of the Philippines, and Roxburgh's specific name is hence adopted. *Polygala polifolia* Presl, previously known only from Luzon, the Caroline Islands, and New Guinea, appears in our Amboina collections, as do *Clerodendron macrostegium* Schauer, previously known only from the Philippines and Ceram, and *Stackhousia intermedia* Bailey var. *philippinensis* Pamp., a characteristic Australian type, previously known from Luzon and Guimaras in the Philippines, Yap, in the Carolines, and the only known representative of the family north of Australia.

The discovery of a representative of the genus *Gyrinopsis* in Amboina, the genus otherwise known only from the Philippines, adds another name to the already long list of genera that are known only from the Philippines and the islands to the south and southeast of the group, including: *Cubilia, Gyrinopsis, Sararanga,*

Microlaena, Ascarina, Phrygilanthus, Spiraeopsis, Clianthus, Wallaceodendron, Koordersiodendron, Reinwardtiodendron, Strophioblachia, Neotrewia, Oncocarpus, Pleiogynium, Tristira, Osbornia, Anompanax, Lepiniopsis, Dedea, Dolicholobium, Eucalyptus, Pimelea, Euphorianthus, Vavaea (also in Java), *Xanthostemon, Schuurmansia, Ganophyllum, Uncinia, Normanbya, Pothoidium, Macropsychanthus, Tetraplasandra* (also in Hawaii), *Couthovia, Nycticalos, Calogyne* (also in southern China), *Phacelophrynium,* and *Paralstonia.* Here we have a list of nearly forty genera, many of them monotypic, and very few that contain numerous species, confined to the Philippines and to the islands to the south and southeast. No list at all approaching this can be compiled for the Philippines and the islands to the west and southwest, or the Sunda Islands proper, including also the Malay Peninsula. A similar list of genera confined to this area would include practically only *Eusuderoxylon, Philbornea, Koompassia, Kunstleria, Clemensia, Polytrema, Hallieracantha, Monophyllea,* and *Adinabotrys* (*Whitfordiodendron*).

As to the limited distribution of species, the special distribution between the Philippines and the islands to the south and southeast is strongly developed, in close correspondence with the special generic relationships, while that with the islands to the west and southwest is correspondingly weak. So far as deductions can be drawn on the basis of our present knowledge of the Philippine and Malayan floras, the evidence preponderatingly points to a closer connection between the Philippines and the regions to the south and southeast than with the islands to the west and southwest of the Archipelago. At any rate, the evidences of floristic relationships between the Philippines and Celebes and the Moluccas is so great that the systematist working on the flora of either area should give special attention to the species already described from the other area in working up his material.

In connection with the present enumeration of Amboina plants included in the series *Reliquiae Robinsonianae,* I am indebted to Doctor O. Beccari, Florence, Italy, for the determination of the palms; to M. C. de Candolle, Geneva, Switzerland, for the treatment of the genus *Piper;* to Doctor Th. Valeton, Buitenzorg, Java, for the treatment of the *Marantaceae;* to J. Sykes Gamble Esq., East Liss, Hants, England, for assistance in determining the identity of the single bamboo enumerated, and to Mr. G. K. Merrill, Rockland, Maine, U. S. A., for the consideration of the lichens.

The present paper, as noted above, is based on the material that cannot definitely be referred to any of the forms figured or described by Rumphius. The most important results of the work of Doctor Robinson in Amboina are to be included in the general report on the species of the Herbarium Amboinense, to be issued in the near future under the title: "An Interpretation of the Herbarium Amboinense."

In closing this introductory statement I would call attention to the fact that through the interest of Doctor J. C. Koningsberger, director of the Botanical Garden, Buitenzorg, Java, Doctor Robinson's work in Amboina was greatly facilitated by the detail of a native assistant from Buitenzorg, the mantri Mardjoeki, to aid him in the collection and preparation of material. The work done by Doctor Robinson in Amboina was in a way coöperative between the Bureau of Science on the one hand, and the Botanical Garden at Buitenzorg, Java, on the other. It is hope that the work accomplished will be to the mutual benefit of both institutions, as well to botanists and other botanical institutions in the world at large.

ENUMERATION OF THE SPECIES

ALGAE

This group is rather poorly represented in Doctor Robinson's Amboina collection, 14 numbers being included in the series *Reliquiae Robinsonianae*, all, or nearly all, marine forms. No report on this material is available for publication.

FUNGI

There are about 217 numbers of fungi included in the series *Reliquiae Robinsonianae*, for the most part minute parasitic forms. This material has been placed in the hands of Doctor Sydow for study, but owing to the exigencies of the present European war, no report is available for publication at this time.

LICHENES

(By G. K. Merrill)

MICROTHELIA (Koerb.) Massalongo

MICROTHELIA GREGARIA G. K. Merr. sp. nov.

Thallus subcortical, effuse, fulvo-fuscous; apothecia collected in trypethelioid stromas, blackish and of irregular shape; perithecia immersed, the black ostiole with a surrounding area of whitish tissue only visible, entire; spores 8, fuscous or decolorate, bilocular, one cell cuneate, the other rounded, 22 to 25 by 8 to 11 μ; asci ventricose; paraphyses distinct, filiform.

Amboina, Lateri, *Rel. Robins. 2435*, on branches of *Eugenia*, altitude 200 meters, August 25, 1913.

PYRENULA (Ach.) Massalongo

PYRENULA MARGINATA (Hook.) Müll.

AMBOINA, Batoe merah River and Hoetoemoeri road, *Rel. Robins. 2410, 2413*, on living and dead tree trunks, altitude about 200 meters, September, 1913.

PYRENULA NITIDA (Weig.) Ach.

AMBOINA, Hitoe lama, *Rel. Robins. 2426*, on trunks of living trees, altitude 200 meters, October, 1913.

PYRENULA SEXLOCULARIS (Nyl.) Müll.

AMBOINA, Mahija, *Rel. Robins. 2416*, on trunks of living trees, altitude about 200 meters, August, 1913.

PHYLLOPORINA Müller

PHYLLOPORINA (STEGESTRINULA) OCTOMERA Müll.

AMBOINA, Hitoe messen and Way uri, *Rel. Robins. 2418 p. p., 2430, 2444 p. p.* On leaves of various trees at low and medium altitudes.

PHYLLOPORINA (STEGEDIASTRUM) MULTIPUNCTATA G. K. Merr. sp. nov.

Thallus rounded, or difform by the confluence of several individuals, effuse, filmy, nebulous at the circumference, lead or ashy-lead in color; perithecia numerous, minute, hemispheric-conoid, ostiole very minute, dimidiate; spores 4- to 6-locular, fusiform, 15 to 17 by 4 to 4.5 μ; paraphyses distinct, lax, filiform; asci clavate-cylindric. Epiphyllous and associated with *Phyllosporina octomera*.

AMBOINA, Hitoe messen, *Rel. Robins. 2418 p. p.*, associated with *P. octomera* Müll. On leaves of trees, altitude about 150 meters.

STRIGULA E. Fries

STRIGULA ELEGANS Fée.

AMBOINA, Ayer putri, *Rel. Robins. 2195*, on leaves of trees at low altitudes, July, 1913.

STRIGULA FEEI Mont.

CELEBES, Macassar, *Rel. Robins. 2473*, on leaves of *Mangifera indica*, July 11, 1913.

STRIGULA COMPLANATA var. **CILIATA** (Mont.) Müll.

AMBOINA, Kati-kati, *Rel. Robins. 2411*, on leaves of *Heritiera litoralis*, October, 1913.

ARTHRONIA (Ach.) A. Zahlbruckner

ARTHRONIA ROBINSONII G. K. Merr. sp. nov.

Parasitic on the thallus of *Phyllosporina* (*Stegestrinula*) *octomera* Müll. Apothecia rounded or difform-rounded, black, plane or slightly convex, scabrous; spores 8, oblong-ellipsoid, 10- to 12-

locular, 34 to 36 by 9 to 11 μ, colorless; asci saccate; paraphyses deficient. Epiphyllous.

AMBOINA, town of Amboina, *Rel. Robins. 2414*, on leaves of *Garcinia mangostana*, July 17, 1913.

BIATORINOPSIS Müller

BIATORINOPSIS FOLIICOLA (Kremp.) Müll.

AMBOINA, *Rel. Robins. 2442 p. p.*, associated with *Lopadium epiphyllum* Mont. on leaves of *Agathis alba*.

COENOGONIUM Ehrenberg

COENOGONIUM INTERPLEXUM Nyl.

AMBOINA, Hitoe messen, *Rel. Robins. 2434, 2438*, on trees, altitude about 300 meters, October, 1913.

LOPADIUM Koerber

LOPADIUM EPIPHYLLUM Müll.

AMBOINA, *Rel. Robins. 2442 p. p.*, associated with *Biatorinopsis foliicola* Müll. on leaves of *Agathis alba*. CELEBES, Macassar, *Rel. Robins. 2474*, on leaves of *Citrus decumana*.

LEPTOGIUM (Ach.) A. Gray

LEPTOGIUM PHYLLOCARPUM var. **DAEDALEUM** (Flot.) Nyl.

AMBOINA, Roemah tiga, *Rel. Robins. 2440*, on trees at low altitudes, July 20, 1913.

LEPTOGIUM TREMELLOIDES var. **AZUREUM** Nyl.

AMBOINA, Kati-kati, *Rel. Robins. 2427*, on trunks of coconut palms at low altitudes, October 6, 1913.

PANNARIA Delise

PANNARIA PANNOSA (Sw.) Del.

AMBOINA, Kati-kati and Way uri, *Rel. Robins. 2443, 2444, p. p.*, on trunks of coconut palms and on leaves of *Eugenia*, September and October, 1913.

PANNARIA FULVESCENS (Mont.) Nyl.

AMBOINA, Roemah tiga, *Rel. Robins. 2423*, on trunks of trees, August, 1913.

COCCOCARPIA Persoon

COCCOCARPIA CILIOLATA Mont.

AMBOINA, Soja, Roemah tiga, and town of Amboina, *Rel. Robins. 2417, 2436, 1237*, on trunks of trees at low altitudes.

COCCOCARPIA HOMALANTHA Nyl.

AMBOINA, Amahoesoe and Lateri, *Rel. Robins. 2406, 2421*, September, 1913, on living and dead branches of trees.

COCCOCARPIA PELLITA (Ach.) Müll.

AMBOINA, Kati-kati, *Rel. Robins. 2424, 2428*, on branches of *Timonius sericeus* at low altitudes.

PARMELIA De Notaris

PARMELIA SULPHURATA Nees & Flot.

AMBOINA, near the town of Amboina, *Rel. Robins. 2422*, on tree trunks near the seashore, October 8, 1913.

PYXINE Nylander

PYXINE COCOES (Sw.) Nyl.

AMBOINA, Kati-kati, *Rel. Robins. 2432, 2446*, on trunks of *Cocos nucifera*, October 6, 1913.

HEPATICAE

There are about 54 numbers of *Hepaticae* in the series *Reliquiae Robinsonianae*. It has been impossible to secure a report on this material from any specialist, and accordingly no attempt has here been made to enumerate the various species.

MUSCI

The mosses are represented in the *Reliquiae Robinsonianae* by about 72 numbers. A report on this material, prepared by Doctor Brotherus, forwarded in December, 1915, failed to reach me and has apparently been lost or destroyed in transit.

PTERIDOPHYTA

The *Pteridophyta* of Doctor Robinson's collection have already been considered in a separate paper by Captain C. R. W. K. van Alderwerelt van Rosenburgh,[6] and those species apparently not described by Rumphius are accordingly not here enumerated. The groups represented in the collection are the *Hymenophyllaceae, Cyatheaceae, Polypodiaceae, Matoniaceae, Gleicheniaceae, Schizaeaceae, Marattiaceae, Ophioglossaceae, Lycopodiaceae, Selaginellaceae*, and *Psilotaceae*.

SPERMATOPHYTA

A. MONOCOTYLEDONS

HYDROCHARITACEAE

HYDRILLA Richard

HYDRILLA VERTICILLATA (Linn. f.) Royle Ill. (1839) 376.

Serpicula verticillata Linn. f. Suppl. (1881) 416.

AMBOINA, Batoe gadjah, *Rel. Robins. 2000*, November 8, 1913, in fresh water at low altitudes.

Central Europe to Australia.

[6] The Amboina Pteridophyta collected by C. B. Robinson. *Philip. Journ. Sci.* 11 (1916) *Bot.* 101–123, *t. 5, 6*.

GRAMINEAE

POLYTRIAS Hackel

POLYTRIAS DIVERSIFLORA (Steud.) Nash in Torreya 5 (1905) 110.

Andropogon diversiflorus Steud. in Zoll. Syst. Verz. (1854) 58.
Andropogon amaurus Büse in Miq. Pl. Jungh. (1854) 360.
Pollinia praemorsa Nees in Steud. Syn. (1854) 409.
Polytrias amaurea O. Ktze. Rev. Gen. Pl. 1 (1891) 788.
Polytrias praemorsa Hack. in DC. Monog. Phan. 6 (1889) 189.

BALI, *Rel. Robins. 2531*, July 7, 1913.

Malay Archipelago and Singapore; introduced into the Philippines and into the West Indies.

POGONATHERUM Beauvois

POGONATHERUM PANICEUM (Lam.) Hack. in Allg. Bot. Zeitschr. 12 (1906) 178.

Saccharum paniceum Lam. Encycl. 1 (1791) 595, *t. 40, f. l.*
Pogonatherum saccharoideum Beauv. Agrost. (1812) 9, *t. 11, f. 7.*

AMBOINA, Negri lama, *Rel. Robins. 1652*, September 8, 1913, on cliffs near streams, altitude 20 meters.

India to Japan, southward through Malaya.

ANDROPOGON Linnaeus

ANDROPOGON HALEPENSIS (Linn.) Brot. Fl. Lusit. 1 (1804) 89, var. **PROPINQUUS** (Hack.) Merr. in Philip. Journ. Sci. 1 (1906) Suppl. 336.

Andropogon propinquus Kunth Enum. 1 (1833) 502.

AMBOINA, Negri lama, *Rel. Robins. 1642*, September 8, 1913, in fields, altitude about 10 meters, locally known as *tebu tebu.*

Ceylon, the Philippines, and the Moluccas (the variety), the species of wide distribution.

THYSANOLAENA Nees

THYSANOLAENA MAXIMA (Roxb.) O. Ktze. Rev. Gen. Pl. 1 (1891) 794.

Agrostis maxima Roxb. Fl. Ind. 1 (1820) 319.
Thysanolaena agrostis Nees in Edinb. New Phil. Journ. 18 (1835) 180.

AMBOINA, Negri lama, *Rel. Robins. 1644*, September 8, 1913, on cliffs near streams, locally known as *bulu perampuan.*

India through Malaya to New Guinea

PASPALUM Linnaeus

PASPALUM SCROBICULATUM Linn. Mant. 1 (1767) 29.

AMBOINA, Koeda mati, *Rel. Robins. 1651*, on margins of a small pond, September 3, 1913.

Widely distributed in the tropics.

PASPALUM CONJUGATUM Berg. in Act. Helvet. 7 (1772) 129, *t. 8.*

AMBOINA, in a sago swamp near the town of Amboina, *Rel. Robins. 1653*, July 25, 1913.

This species, originating in tropical America, has doubtless been introduced into Amboina since Rumphius's time. Now in most tropical countries.

ISACHNE R. Brown

ISACHNE MILIACEA Roth Nov. Pl. Sp. (1821) 58.

AMBOINA, in wet places near the town of Amboina, *Rel. Robins. 1654*, July 25, 1913.

India to Malaya and Polynesia, reported also from South America.

PANICUM Linnaeus

PANICUM PILIPES Nees & Arn. ex Büse in Miq. Pl. Jungh. (1854) 376.

Panicum hermaphroditum Steud. Syn. 1 (1854) 67.

AMBOINA, Hatiwe, *Rel. Robins. 1648*, September 15, 1913.

India to Madagascar, Malaya, tropical Australia, and Polynesia.

PANICUM PATENS Linn. Sp. Pl. (1753) 86.

AMBOINA, Kati-kati, in wet meadows, *Rel. Robins. 1640*, October 19, 1913.

Linnaeus, Mantissa 2 (1771) 232, adds to *Panicum patens* a reference to *Panicum patens* Burm., Fl. Ind. (1768) 26, *t. 10*, *f. 3*, who in turn cites Rumph. Herb. Amb. 6, *t. 5*, *f. 3*. *Panicum patens* Burm., however, is a species entirely different from *Panicum patens* Linn.; Rumphius's figure is *Oplismenus compositus* Beauv.

India to southern China, Malaya, and Polynesia.

OPLISMENUS Beauvois

OPLISMENUS BURMANNII (Retz.) Beauv. Agrost. (1812) 54.

Panicum burmannii Retz. Obs. 3 (1783) 10.

AMBOINA, Ayer putri, *Rel. Robins. 1645*, July 29, 1913, in forests.

Tropical Africa and Asia to Japan and Malaya.

PENNISETUM Persoon

PENNISETUM MACROSTACHYUM Trin. in Mém. Acad. St. Pétersb. VI 3^2 (1835) 177.

Saccharum caninum Reinw. in Blume Cat. Gew. Buitenz. (1823) 38, *nomen nudum*.

AMBOINA, Hoenoet, on dry hills, *Rel. Robins. 1643*, October 7, 1913.

Luzon to Java, New Guinea, and Polynesia.

SPOROBOLUS R. Brown

SPOROBOLUS INDICUS (Linn.) R. Br. Prodr. (1810) 170.

Agrostis indica Linn. Sp. Pl. (1753) 63.

AMBOINA, Koesoe koesoe sereh, *Rel. Robins. 1656*, along roadsides.

Tropics of the World.

LEPTASPIS R. Brown

LEPTASPIS URCEOLATA (Roxb.) R. Br. in Benn. Pl. Jav. Rar. (1838–52) 23, *t. 6*.

Pharus urceolatus Roxb. Fl. Ind. ed. 2, 3 (1832) 611.

AMBOINA, Waë, *Rel. Robins. 1655*, November 26, 1913, in thin forests, altitude 10 to 20 meters.

Malay Peninsula and Archipelago, the Philippines, and New Guinea.

GARNOTIA Brongniart

GARNOTIA STRICTA Brongn. Bot. Duperry Voy. (1829) 132, *t. 21.*

AMBOINA, Salahoetoe, *Rel. Robins. 1649*, on rocks and on prostrate logs by streams, altitude 250 meters, November 27, 1913.

India to the Philippines and Malaya, and the Hawaiian Islands.

CHLORIS Swartz

CHLORIS BARBATA Sw. Fl. Ind. Occ. 1 (1797) 200.

AMBOINA, Batoe merah, *Rel. Robins. 1647*, August 5, 1913, along roadsides.

A native of tropical America, probably introduced into Amboina since Rumphius's time; now in all tropical countries.

CENTOTHECA Desvaux

CENTOTHECA LATIFOLIA (Osbeck) Trin. Fund. Agrost. (1820) 141.

Holcus latifolius Osbeck, Dagbok Ostind. Resa (1757) 247.

Cenchrus lappaceus Linn. Sp. Pl. ed. 2 (1763) 1488.

Centotheca lappacea Desv. in Nuov. Bull. Soc. Philomath. 2 (1810) 189.

Centotheca malabarica Merr. in Philip. Journ. Sci. 1 (1906) Suppl. 385, non *Poa malabarica* Linn.

AMBOINA, Negri lama, Soja, and near the town of Amboina, *Rel. Robins. 1646*, July, August, and September, 1913.

Tropical Africa and Asia through Malaya to Australia and Polynesia.

ERAGROSTIS Host

ERAGROSTIS UNIOLOIDES (Retz.) Nees ex Steud. Nom. ed. 2, 2 (1840) 364.

Poa unioloides Retz. Obs. 5 (1789) 19.

Eragrostis amabilis Wight & Arn. in Hook. & Arn. Bot. Beechey Voy. (1841) 251, excl. syn. Linn.

AMBOINA, Koesoe koesoe sereh, *Rel. Robins. 1650*, August 12, 1913, along roads.

Tropical Africa, Asia, and Malaya, introduced into Florida.

BAMBUSA Schreber

BAMBUSA GLAUCESCENS (Willd.) Sieb. ex Munro in Trans. Linn. Soc. 26 (1868) 89, in syn.; Merr. in Philip. Journ. Sci. 7 (1912) Bot. 230.

Ludolphia glaucescens Willd. in Ges. Naturf. Fr. Berl. Mag. 2 (1808) 320.

Bambusa nana Roxb. Hort. Beng. (1814) 25, Fl. Ind. ed. 2, 2 (1832) 199.

AMBOINA, Koeda mati, *Rel. Robins. 1605*, September 3, 1913, introduced and probably cultivated but left to grow naturally. Locally known as *bulu china.*

CYPERACEAE

KYLLINGA Rottboell

KYLLINGA BREVIFOLIA Rottb. Descr. et Ic. Pl. (1773) 13, *t. 4, f. 3.*

AMBOINA, near the town of Amboina, *Rel. Robins. 1897*, July 25, 1913, in a meadow, associated with *Kyllinga monocephala* Rottb.

All warm countries.

PYCREUS Beauvois

PYCREUS NITENS (Vahl) Nees in Linnaea 7 (1834) 283; Nov. Act. Acad. Nat. Cur. 19 (1843) Suppl. 1: 53.

Cyperus nitens Vahl Enum. 2 (1806) 331.

Cyperus pumilus Linn. Cent. Pl. 2 (1755) 6, Amoen. Acad. 4 (1759) 302, non *Pycreus pumilus* Nees.

AMBOINA, Koesoekoesoe sereh, *Rel. Robins. 1891*, August 12, 1913, along roadsides, altitude about 250 meters.

Warmer parts of the Old World.

CYPERUS Linnaeus

CYPERUS COMPRESSUS Linn. Sp. Pl. (1753) 46.

AMBOINA, near the town of Amboina along sandy beaches, *Rel. Robins. 1896*, August 22, 1913.

Tropics of both hemispheres.

CYPERUS HASPAN Linn. Sp. Pl. (1753) 45.

AMBOINA, in meadows, near the town of Amboina, *Rel. Robins. 1898*, August 20, 1913.

Tropics of both hemispheres.

CYPERUS ZOLLINGERI Steud. Syn. Pl. Cyp. (1855) 17.

AMBOINA, Soja road, *Rel. Robins. 1888*, August 1, 1913, altitude 50 meters; along roadsides.

Tropical Africa and Asia to Queensland.

TORULINIUM Desvaux

TORULINIUM FERAX (L. C. Rich.) Ham. Prodr. Pl. Ind. Occ. (1825) 15 (*ferox*).

Cyperus ferax L. C. Rich. in Act. Soc. Hist. Nat. Paris 1 (1792) 106.

Mariscus ferax C. B. Clarke in Hook. f. Fl. Brit. Ind. 6 (1893) 624.

Torulinium confertum Desv. in Ham. Prodr. Pl. Ind. Occ. (1825) 15.

AMBOINA, near the town of Amboina, in wet places, *Rel. Robins. 1893*, August 20, 1913.

All warm countries.

FIMBRISTYLIS Vahl

FIMBRISTYLIS ANNUA (All.) R. & S. Syst. 2 (1817) 95.

Scirpus annuus All. Fl. Pedem. 2 (1785) 277.

Fimbristylis diphylla Vahl Enum. 2 (1806) 289.

Three forms of this polymorphous species occur in the collection from Amboina, Batoe merah, *Rel. Robins. 1902;* Soja road, *Rel. Robins. 1901;* and Koeda mati, *Rel. Robins. 1900*, all collected in August and September.

All warm countries.

FIMBRISTYLIS FUSCA (Nees) Benth. ex C. B. Clarke in Hook. f. Fl. Brit. Ind. 6 (1893) 649.

Abildgaardia fusca Nees in Wight Contrib. (1834) 95.

AMBOINA, Soja road, *Rel. Robins, 1887*, August 1, 1913, on grassy hillsides, altitude about 200 meters.

India to China and Malaya.

FIMBRISTYLIS MILIACEA (Burm.) Vahl Enum. 2 (1806) 287.

Scirpus miliaceus Burm. Fl. Ind. (1768) 22, *t. 9, f. 2.*

AMBOINA, Hoenoet, *Rel. Robins. 1894*, October 18, 1913, in grasslands, altitude about 150 meters.

Hasskarl, Neue Schlüssel (1866) 151, has suggested that *Gramen bufonium* Rumph., Herb. Amb. 6:4, is *Fimbristylis miliacea* Vahl.

Tropics of the World.

SCIRPUS Linnaeus

SCIRPUS ERECTUS Poir. in Lam. Encycl. 6 (1804) 761.

CELEBES, Macassar, *Rel. Robins. 2453*, July 11, 1913.

Widely distributed in both hemispheres.

LIPOCARPHA R. Brown

LIPOCARPHA MICROCEPHALA (R. Br.) Kunth Enum. 2 (1837) 268.

Hypaelyptum microcephalum R. Br. Prodr. (1810) 220.

AMBOINA, Paso and Koesoekoesoe sereh, *Rel. Robins. 1890*, August and September, 1913, roadsides.

Malay Peninsula to Australia.

RYNCHOSPORA Vahl

RYNCHOSPORA RUBRA (Lour.) Makino in Bot. Mag. Tokyo 17 (1903) 180.

Schoenus ruber Lour. Fl. Cochinch. (1790) 41.

Rynchospora wallichiana Kunth Enum. 2 (1837) 289.

AMBOINA, Soja road, *Rel. Robins. 1899*, August 1, 1913, on grassy hillsides, altitude about 100 meters.

Tropical Africa and Asia to Japan, southward through Malaya to Australia.

BAUMEA Gaudichaud

BAUMEA GLOMERATA Gaudich. in Freyc. Voy. Bot. (1826) 416, *t. 29.*

Cladium globiceps C. B. Clarke in Kew Bull. Add. Ser. 8 (1908) 46.

AMBOINA, Amahoesoe, *Rel. Robins, 1895*, on steep banks, altitude about 80 meters.

I am not sure that the identification of this specimen with *Baumea glomerata* Gaudich. is correct, as I have not access to the original description and figure, while the description given by other authors is very short and imperfect. The type, however, was from the Moluccas. The specimen very closely resembles a series of allied forms that have been described as *Baumea deplanchei* Boeckl., of New Caledonia; *Cladium colpoides* Laut., of New Guinea; *Cladium sinuatum* Ridl., of New Guinea; *Cladium juncoides* Elm., of the Philippines; and *Cladium gaudichaudii* W. F. Wight of the Caroline Islands.

VINCENTIA Gaudichaud

VINCENTIA ROBINSONII sp. nov.

Dense caespitosa, glabra, usque ad 1 m alta; foliis equitantibus, coriaceis, glabris, 1 ad 1.5 cm latis, obscure acuminatis; inflorescentiis longe pedunculatis, paniculatis, paniculis circiter 30 cm longis, spiculis omnibus sessilibus, fasciculatis, brunneis, circiter 5 mm longis, filamentis longe exsertis, usque ad 2.5 cm longis.

A densely tufted, perennial, glabrous plant, reaching a height of at least 1 m, the roots stiff, fibrous, the leaves equitant, more or less crowded in the lower 10 cm, up to 90 cm in length, 1 to 1.5 cm wide, straight, coriaceous, smooth, gradually narrowed upward to the obscurely acuminate apex, pale and shining when dry. Inflorescence apparently about as long as the leaves, the peduncle compressed, bearing a few, distant leaves smaller than the basal leaves, the uppermost one bract-like and about 5 cm long. Panicles brown, about 30 cm long, the lower two branches from the axil of the uppermost reduced leaves distant from the others, slender, up to 20 cm in length, somewhat flexuous, perhaps somewhat nodding, the branchlets subtended by a sheathing bract. Spikelets sessile on the ultimate branchlets, usually three in a group, brown, about 5 mm long. Empty glumes two, oblong-ovate to ovate, somewhat keeled, about 3 mm long, rather abruptly and slenderly acuminate. Flowering glumes two, rarely three, 4 to 4.5 mm long. Ovary narrowly ovoid, glabrous, narrowed upward, smooth, 3-angled; style, including the three, slender, 2 mm long arms, 5 mm in length. Stamens 3, the filaments very slender, 2 to 2.5 cm long. Upper two or three glumes empty.

AMBOINA, Salahoetoe, *Rel. Robins. 1893*, November 27, 1913, terrestrial on open hillsides, most abundant at an altitude of about 900 meters.

In aspect this species much resembles *Vincentia malesiaca* Stapf (*Cladium latifolium* Merr.), but it is at once distinguished by its very long and slender filaments, these the most striking character of the present species. For a consideration of the genera *Baumea* and *Vincentia* in relation to *Cladium*, see Stapf in Journ. Linn. Soc. Bot. 42 (1914) 178, 179.

THORACOSTACHYUM Kurz

THORACOSTACHYUM LUCBANENSE (Elm.) Kükenth. in herb. comb. nov.

Mapania lucbanensis Elm. Leafl. Philip. Bot. 2 (1909) 573.

AMBOINA, Hitoe messen, *Rel. Robins. 1889*, October 18, 1913, in forests, altitude about 250 meters.

Previously known only from Luzon. The Amboina specimen has immature spikelets, but agrees in all essential details with our full series

of specimens from Luzon. The leaves are slightly narrower than in the Luzon plant.

DIPLACRUM R. Brown

DIPLACRUM CARICINUM R. Br. Prodr. (1810) 241.

AMBOINA, Kati-kati, *Rel. Robins. 1886*, October 5, 1913, in clearings, altitude about 80 meters.

India to southern China, through Malaya to Queensland.

PALMAE

GRONOPHYLLUM Scheffer

GRONOPHYLLUM MICROCARPUM Scheff. in Ann. Jard. Bot. Buitenz. 1 (1876) 153.

AMBOINA, Waë, *Rel. Robins. 1610, 1611*, in light forests, altitude about 20 meters, locally known as *waylilin*. The specimens were determined by Dr. O. Beccari.

The type of the species was from Ceram Island.

DAEMONOROPS Blume

DAEMONOROPS sp.

AMBOINA, Salahoetoe, *Rel. Robins. 1613, 1612*, November 27, 1913, on rather open slopes, altitude 850 to 900 meters.

Doctor Beccari has reported this as a distinct new species, but no diagnosis of it is at present available for publication.

COMMELINACEAE

ANEILEMA R. Brown

ANEILEMA MALABARICUM (Linn.) Merr. in Philip. Journ. Sci. 7 (1912) Bot. 232.

Tradescantia malabarica Linn. Sp. Pl. ed. 2 (1762) 412.
Commelina nudicaulis Burm. Fl. Ind. (1768) 17, *t. 8, f. 1.*
Commelina nudiflorum Linn. Mant. 1 (1767) 177.
Aneilema nudiflorum R. Br. Prodr. (1810) 271.

AMBOINA, Paso, Koeda mati, and Soja, *Rel. Robins. 1829, 1830*, August to November, 1913, in waste places, fallow ground, on clay banks, etc., altitude sea level to 250 meters.

India to southern China and Malaya.

FORRESTIA Lesson

FORRESTIA HISPIDA Lesson & A. Rich. Sert. Astrolab. (1832) 2, *t. 1.*

AMBOINA, Soja and Way tommo, *Rel. Robins. 1831*, August, 1913, on river banks and in forests, altitude 80 to 400 meters.

In various forms from Formosa to Sumatra and New Guinea.

POLLIA Thunberg

POLLIA SORZOGONENSIS (E. Mey.) Steud. Nomen. ed. 2, 2 (1840) 368.

Aclisia sorzogonensis E. Mey. in Presl Rel. Haenk. 1 (1827) 138, *t. 25.*

AMBOINA, Koesoekoesoe sereh, *Rel. Robins. 1828*, August, 23, 1913; Paso, *Rel. Robins. 1827*, September 9, 1913, in meadows at low altitudes.

India to the Philippines, through Malaya to the Moluccas.

LILIACEAE

SMILAX Linnaeus

SMILAX sp. ?

AMBOINA, Hitoe messen, *Rel. Robins. 2008*, October 13, 1913, in forests, altitude about 150 meters.

Possibly a species of *Heterosmilax*, but the flowers are unknown. The species is a very characteristic one, unarmed, with solitary umbels of comparatively large fruits which are blue and fleshy when fresh, globose, about 1.5 cm in diameter when dry, and shining. The prominently reticulate, 5-nerved leaves are 13 to 30 cm long, 5 to 16 cm wide.

IRIDACEAE

BELAMCANDA Adanson

BELAMCANDA CHINENSIS (Linn.) DC. in Red. Lil. (1807) *t. 121.*

Ixia chinensis Linn. Sp. Pl. (1753) 36.

Belamcanda punctata Moench Meth. (1794) 529.

AMBOINA, Liang, *Rel. Robins, 2001*, November 29, 1913, along roadsides at low altitudes.

A native of China, now widely distributed in cultivation; in Amboina apparently an escape from cultivation.

BURMANNIACEAE

BURMANNIA Linnaeus

BURMANNIA LONGIFOLIA Becc. Malesia 1 (1878) 244.

AMBOINA, Salahoetoe, *Rel. Robins. 1849*, November 27, 1913, terrestrial, altitude from 200 to 700 meters and above.

Malay Peninsula (Selangor), Borneo, Mindoro, Negros, Mindanao, Amboina, and New Guinea.

MARANTACEAE

(By TH. VALETON)

PHRYNIUM Willdenow

PHRYNIUM CAPITATUM Willd. Sp. Pl. 1 (1797) 17.

AMBOINA, Way uri, *Rel. Robins. 2035*, September 9, 1913, near streams, altitude about 50 meters, locally known as *pohon rit*.

The specimen is in fruit only, but is possibly referable to this species although Willdenow's species is otherwise not known from the eastern part of the Archipelago. India to southern China, the Philippines, Sumatra, and Java.

B. DICOTYLEDONS

PIPERACEAE

(By C. DECANDOLLE)

PIPER Linnaeus

PIPER GELALAE C. DC. sp. nov.

Ramulis dense villosis; foliis breviter petiolatis, limbo oblongo-ovato basi aequilatera utrinque acuto apice acuminato utrinque

villoso, 5-plinervio nervo centrali nervum utrinque adscendentem opposite ex 5–7 cm supra basin mittente, nervo laterali adscendente utrinque a basi soluto, petiolo villoso basi ima vaginante; pedunculo villoso petiolum superante, spica subflorente quam limbi dimidium breviore tenui, rhachi dense hirsuta, bracteae glabrae pelta rotunda centro pedicellata, staminibus 2, antheris subreniformibus 4-valvatis.

Dioicum, 1.5 m altum. Ramuli spiciferi 1 mm crassi, collenchyma in fasciculos discretos a latere productos dispositum et haud libriforme, fasciculi intramedullares 1-seriati, canalis lysigenus nullus. Limbi in sicco membranacei minute et inconspicue pellucido-punctulati, usque ad 12 cm longi et 4 cm lati. Petioli 5 mm, pedunculi 10 mm longi. Spica subflorens 3.3 cm longa, in vivo flava, bracteae pelta 0.5 mm diam.

AMBOINA, Gelala, *Rel. Robins. 1606*, July 16, 1913, in light forests along roadsides, altitude about 5 meters, locally known as *sirioetan* and *siriboea lakilaki*.

PIPER NUDIRAMUM C. DC. sp. nov.

Ramulis glabris; foliis modice petiolatis glabris, limbo rotundato-ovato basi rotundato vel repando-rotundato apice breviter acuminato, nervo centrali nervos arcuatim adscendentes utrinque 4 mittente quorum supremus a 2 cm supra basin solutus et infimus tenuissimus, petiolo fere usque ad limbum vaginante; stirpis fem. pedunculo glabro petiolum fere aequante, spica limbi dimidium paullo superante, bracteae pelta orbiculari centro pedicellata, ovariis arcte condensis ovatis glabris, stigmatibus 3 minutis.

Dioicum, ramuli striolati in sicco flavicantes, spiciferi circiter 2 mm crassi, collenchyma subcontinuum libriforme, fasiciculi intramedullares 1-seriati, canalis lysigenus centralis pluresque peripherici. Limbi in sicco tenuiter membranacei minutissime pellucido-punticulati, circiter 13.5 cm longi et 10.5 cm lati. Petioli fere 2.5 cm longi. Spica florens circiter 3.5 mm crassa; stigmata sessilia. Species P. austrocaledonici proxima, foliorum nervatione ac consistancia ob illo descrepans.

AMBOINA, Itu, *Warburg 17652*, h. reg. Berol.

ULMACEAE

CELTIS Tournefort

CELTIS PANICULATA (Endl.) Planch. in Ann. Sci. Nat. III 10 (1848) 305.

Solenostigma paniculatum Endl. Prodr. Fl. Norfolk. (1833) 42.

AMBOINA, Liang, *Rel. Robins. 1795*, November 29, 1913, altitude about 15 meters, locally known as *wawakar*.

The identification of the Amboina specimen has been made wholly from the description, and is, accordingly not certainly correct. If not *Celtis paniculata* Planch., then it represents a very closely allied form. The cymes, in fruit, are shorter than the petioles, and the leaves are notably dark colored when dry.

Timor laut and New Guinea to Queensland, New Caledonia, and Tahiti.

GIRONNIERA Gaudichaud

GIRONNIERA AMBOINENSIS Lauterb. in Engl. Bot. Jahrb. **50** (1913) 326.

AMBOINA, Hoetoemoeri road, *Rel. Robins. 1794*, September 30, 1913, locally known as *umian utan*.

A species known only from Amboina, considered by Lauterbach to be closely allied to *Gironniera rhamnifolia* Blume. The material I have placed under *G. amboinensis* Lauterb. rather strongly resembles *Gironniera subaequalis* Planch.

TREMA Loureiro

TREMA ORIENTALIS (Linn.) Blume Mus. Bot. Lugd. Bat. **2** (1856) 62.

Celtis orientalis Linn. Sp. Pl. (1753) 1044.

AMBOINA, Amahoesoe, *Rel. Robins. 1763*, August 13, 1913, on limestone hills at an altitude of about 40 meters, locally known as *rufu*.

Himalayan region to Formosa southward to Queensland, with varieties extending to Polynesia and Hawaii.

Doubtless this was included by Rumphius in his general conception of *Cortex piscatorium*, but his description and figure do not apply to this common and well-known form, but to *T. virgata* Blume.

MORACEAE

FATOUA Gaudichaud

FATOUA PILOSA Gaudich. Bot. Freyc. Voy. (1826) 509.

Urtica japonica Thunb. Fl. Jap. (1784) 70, non Linn. f.
Fatoua japonica Blume Mus. Bot. 2 (1861) *t. 38*.

BOETON, *Rel. Robins. 2502*, July 13, 1913.

Eastern Asia, Malaya, and Polynesia.

MALAISIA Blanco

MALAISIA sp.?

AMBOINA, Soja, *Rel. Robins. 1691*, October 24, 1913, in light woods, altitude about 375 meters.

Doctor Robinson describes this as a small tree about 4 m high, but the specimens look as if they were from a scandent shrub. If a *Malaisia*, then the specimens certainly represent an undescribed species. Unfortunately, however, our material presents only matured infructescences, and in the absence of flowers its generic position cannot be determined with certainty. The mature receptacle, when fresh, is yellow, succulent, and the carpels are nearly black.

FICUS Linnaeus

FICUS MYRIOCARPA Miq. Ann. Mus. Bot. Lugd. Bat. 3 (1867) 230.

AMBOINA, Nontetoe, and Negri lama, *Rel. Robins. 1687, 1688,* July and September, 1913, along small streams, at low altitudes, locally known as *tulan babi.*

A most characteristic species, known only from Amboina.

FICUS VILLOSA Blume Bijdr. (1825) 441.

AMBOINA, Way tommo, *Rel. Robins. 1677,* August 17, 1913, climbing on *Ficus* trees, altitude 45 meters, locally known as *tali mera.*

Malay Peninsula and Archipelago to the Philippines.

FICUS CONGESTA Roxb. Fl. Ind. ed. 2, 3 (1832) 560.

AMBOINA, Negri lama, *Rel. Robins. 1690,* in light forests, altitude about 20 meters, locally known as *gohi batu.*

A species manifestly closely allied to the Philippine *Ficus nota* (Blanco) Merr. It was originally described from Amboina specimens cultivated in the botanic garden at Calcutta. King includes it in the doubtful and imperfectly known species.[1] The Amboina specimens agree fairly well with Roxburgh's description and with the figure given by Wight, Ic. *t. 644.*

FICUS AURITA Reinw. ex Blume Bijdr. (1825) 462.

AMBOINA, Halong and Way tommo, *Rel. Robins. 1679, 1689,* August, September, 1913, along river banks, altitude 10 to 40 meters.

A most characteristic species known definitely only from Amboina, but reported from New Guinea, and also from the "Moluccas," although Reinwardt's original specimen probably came from Amboina.

FICUS UROPHYLLA Wall. Cat. (1831) no. 4483.

AMBOINA, Hitoemoeri road, *Rel. Robins. 1683,* September 30, 1913, in light forests, altitude about 150 meters.

The specimen is referable to this widely distributed Indo-Malayan species as it is interpreted by King.

FICUS RETUSA Linn. var. **NITIDA** King in Ann. Bot. Gard. Calcutta 1 (1888) 51.

AMBOINA, near Castle Victoria, town of Amboina, *Rel. Robins. 1678,* September 13, 1913, locally known as *waringin.*

FICUS RIGESCENS Miq. Ann. Mus. Bot. Lugd. Bat. 3 (1867) 278.

AMBOINA, Kati-kati, *Rel. Robins. 1674,* October 7, 1913, in light forests, altitude 80 meters, locally known as *tapialu.*

Ficus rigescens Miq. was described from Amboina material, and has been reduced to *Fiscus ramentacea* Roxb.; however, I consider that it represents a valid species, distinct from the form described by Roxburgh.

FICUS RIGIDA Blume Bijdr. (1825) 465.

Ficus gibbosa Blume Bijdr. (1825) 466.

AMBOINA, Eri, *Rel. Robins. 1686,* September 22, 1913, along the seashore.

The specimen is not quite identical with the Javan form but is probably referable to this species.

[1] Ann. Bot. Gard. Calcutta 1 (1888) 180.

FICUS HENSCHELII sp. nov. § *Eusyce.*

Arbor circiter 8 m alta ramulis junioribus petiolis pedicellisque adpresse villosis; foliis alternis, chartaceis vel submembranaceis, integris, nitidis, usque ad 20 cm longis, oblongo-ovatis ad elliptico-ovatis, prominente acuminatis, basi rotundatis, nervis utrinque 6, subtus prominentibus; receptaculis obovoideis, circiter 1 cm longis, parcissime pubescentibus, pedicellis subaequilongis.

A tree about 8 m high, the young branchlets, petioles, and pedicels appressed-villous with pale-brownish hairs. Branches reddish-brown, terete, glabrous. Leaves alternate, chartaceous or submembranaceous, oblong-ovate to elliptic-ovate, entire, smooth, 18 to 20 cm long, 9 to 10 cm wide, prominently acuminate, the acumen stout, blunt, 1.5 to 2 cm long, base rounded, somewhat 3-nerved, the upper surface somewhat olivaceous, shining, the lower slightly paler, sparingly pubescent on the midrib and lateral nerves; nerves 6 on each side of the midrib, prominent on the lower surface, anastomosing, the primary reticulations lax, distant, subparallel; petioles 3.5 to 5 cm long; stipules lanceolate, acuminate, densely pubescent, about 1 cm long. Receptacles in the axils of fallen leaves, mostly in pairs, obovate, about 1 cm long, apex rounded, base somewhat narrowed, externally smooth and rather pale when dry, very sparingly pubescent with scattered appressed hairs, the pedicels appressed-villous, about as long as the receptacles, the three bracteoles at the apex about 1.5 mm long.

AMBOINA, Hitoe messen, *Rel. Robins. 1684*, October 18, 1913, in forests, altitude about 250 meters.

A species in the group with *Ficus alba* Reinw., apparently most closely allied to the Philippine species *Ficus camiguinensis* Merr. Dedicated to Dr. A. G. E. T. Henschel, author of "Vita G. E. Rumphii, Plinii indici, accedunt specimen materiae Rumphianae medicae clavisque herbarii et thesuarii amboinensis" (1833).

FICUS HASSKARLII sp. nov. § *Eusyce.*

Arbor circiter 6 m alta, species praecedente similis et affinis, differt foliis minoribus, usque ad 12 cm longis, tenuiterque acuminatis, petiolis multo brevioribus, receptaculis globosis.

A tree about 6 m high, the younger branchlets, petioles, and pedicels appressed subferruginous-villous. Branches terete, dark reddish-brown, smooth or somewhat wrinkled when dry. Leaves alternate, chartaceous, pale-olivaceous, oblong to oblong-ovate, 7 to 12 cm long, 3 to 6 cm wide, entire, base rounded or somewhat cordate, apex slenderly and acutely acuminate; lateral nerves 6 to 8 on each side of the midrib, prominent on the

lower surface, anastomosing, the reticulations lax; petioles 1 to 1.5 cm long; stipules lanceolate, acuminate, nearly 1 cm long, densely appressed-pubescent with ferruginous hairs. Receptacles numerous, solitary or in pairs in the axils of fallen leaves, orange when fresh, pale-brownish and smooth when dry, very slightly pubescent with appressed hairs, about 8 mm in diameter, their peduncles about 5 mm long.

AMBOINA, Hoetoemoeri road, *Rel. Robins. 1685*, September 30, 1913, on a fern-covered hillside, altitude about 250 meters.

A species similar, and manifestly closely allied, to *Ficus henschelii* Merr., differing in its much smaller leaves, shorter petioles and pedicels, and globose receptacles. It is dedicated to Dr. J. K. Hasskarl, author of "Neuer Schlüssel zu Rumph's Herbarium amboinense" (1866).

FICUS sp.

AMBOINA, Way tommo and Negri lama, *Rel. Robins. 1675, 1676*, August and September, 1913, along river banks, altitude 20 to 40 meters, locally known as *gondal* and as *gohi ayer*.

A species, perhaps undescribed, allied to the Philippine species *Ficus benguetensis* Merr. and *F. laevicarpa* Elm.

URTICACEAE

CYPHOLOPHUS Weddell

CYPHOLOPHUS MOLUCCANUS (Blume) Miq. Ann. Mus. Bot. Lugd. Bat. 4 (1869) 305.

Urtica moluccana Blume Bijdr. (1825) 491.

Cypholophus macrocephalus Wedd. in Ann. Sci. Nat. Bot. IV 1 (1854) 198.

AMBOINA, Soja and Batoe merah River, *Rel. Robins. 1697*, September and October, 1913, in ravines and along streams, altitude 20 to 250 meters.

Widely distributed in Malaya and Polynesia.

CYPHOLOPHUS COERULEUS (Blume) Wedd. in DC. Prodr. 16^1 (1869) 235^{12}.

Urtica coerulea Blume Bijdr (1825) 495.

AMBOINA, Hitoe messen, *Rel. Robins. 1909*, October 10, 1913, on forested limestone hills, altitude about 150 meters, the fruits bluish-green when fresh.

A species allied to *Cypholophus lutescens* (Blume) Wedd. It is known only from the Moluccas, and the type was probably from Amboina.

LEUCOSYKE Zollinger and Moritzi

LEUCOSYKE CAPITELLATA (Poir.) Wedd. in DC. Prodr. 16^1 (1869) 235^{27}.

Urtica capitellata Poir. in Lam. Encycl. Suppl. 4 (1816) 227.

AMBOINA, Soja and Tengah tengah, *Rel. Robins. 1906, 1907*, August and November, 1913, in forests, altitude 25 to 375 meters, locally known as *sasapu utan*.

Formosa to the Moluccas and Java.

FLEURYA Gaudichaud

FLEURYA RUDERALIS (Forst.) Gaudich. Bot. Freyc. Voy. (1826) 497.

Urtica ruderalis Forst. Prodr. (1784) 334.

AMBOINA, Batoe merah, *Rel. Robins. 1908*, July 20, 1913, on coral rocks at low altitudes, locally known as *daun gattal babi*. BOETON, Baoe-baoe, *Rel. Robins. 2491*, July 13, 1913.

Java to the southern Philippines, Marianne, and Society Islands.

PILEA Lindley

PILEA MICROPHYLLA (Linn.) Liebm. Vidensk. Selsk. Skr. 5² (1851) 302.

Parietaria microphylla Linn. Syst. ed. 10 (1759) 1308.
Pilea muscosa Lindl. Coll. Bot. (1824) *t. 4*.

AMBOINA, *Rel. Robins. 1911*, on damp stones, town of Amboina, July 19, 1913.

Introduced from tropical America; now in all tropical countries.

PROCRIS Commerson

PROCRIS LAEVIGATA Blume Bijdr. (1825) 508.

Procris philippinensis C. B. Rob. in Philip. Journ. Sci. 5 (1910) Bot. 505.

AMBOINA, Hitoe messen, *Rel. Robins. 1916*, October 10, 1913, on trees and limestone boulders, altitude about 150 meters.

The specimen appears to be typical *Procris laevigata* Blume, rather than Procris lignescens (Hallier f.) (*Elatostema lignescens* Hallier f.) which has been credited to Amboina by Hallier f.

India and Ceylon to Malaya and the Philippines.

ELATOSTEMA Forster

ELATOSTEMA MACROPHYLLUM Brongn. Bot. Voy. Coquille (1829) 207, *t. 45*.

AMBOINA, Soja, *Rel. Robins. 1915*, August 2, 1913, in forests, altitude about 400 meters; locally known as *assayu utan*.

The type of the species was from Amboina; it extends from Java to Fiji.

ELATOSTEMA SESQUIFOLIUM (Reinw.) Hassk. Cat. Hort. Bogor. (1844) 79.

Procris sesquifolia Reinw. ex Blume Bijdr. (1825) 511.

AMBOINA, Kati-kati, *Rel. Robins. 1913*, October 17, 1913, near streams, altitude 70 meters.

This species has been reduced by Weddell to *Elatostema integrifolium* (Don) Wedd., of India, but the Malayan specimens appear quite different from Indian material.

Widely distributed in Malaya and the Philippines, perhaps extending to tropical Asia.

ELATOSTEMA ULMIFOLIUM Miq. Pl. Jungh. (1851) 21.

AMBOINA, Hitoe lama, *Rel. Robins. 1910*, October 8, 1913, on limestone rocks, altitude about 150 meters.

Weddell makes this *Elatostema sessile* Forst. var. *ulmifolium* (Miq.)

Wedd. in DC. Prodr. 16[1] (1869) 173. I cannot distinguish the Amboina material from authentically named Javan specimens representing Miquel's species.

ELATOSTEMA sp.

AMBOINA, Salahoetoe, *Rel. Robins. 1912*, on rocks in ravines, altitude 200 meters, November 27, 1913.

A small, slender plant, perhaps undescribed, but the material is rather scanty.

ELATOSTEMATOIDES C. B. Robinson

ELATOSTEMATOIDES POLIONURUM (Hallier f.) comb. nov.

Elatostema polioneurum Hallier f. in Fedde Repert. 2 (1906) 62.

AMBOINA, Hatiwe and Kati-kati, *Rel. Robins. 1814, 1917*, September and October, 1913, along streams, altitude 10 to 70 meters.

Amboina and Celebes; very closely allied to the Philippine *Elatostematoides manillense* C. B. Rob.

PROTEACEAE

HELICIA Loureiro

HELICIA MOLUCCANA (R. Br.) Blume in Ann. Sci. Nat. II 1 (1834) 216.

Rhopala moluccana R. Br. in Trans. Linn. Soc. 10 (1811) 191.

AMBOINA, Hitoe messen, *Rel. Robins. 1657*, October 13, 1913, in forests, altitude about 200 meters.

The type of this species was from Amboina. Its further distribution in the Moluccas is uncertain, as it has been reported only from Amboina.

SANTALACEAE

EXOCARPUS Labillardière

EXOCARPUS AMBOINENSIS sp. nov.

Arbor (vel frutex scandens?) glabra, ramis teretibus, ramulis tenuibus, angulatis; foliis firme chartaceis vel subcoriaceis, oblongis, usque ad 11 cm longis, utrinque subaequaliter angustatis, acutis vel subacutis, basi acutis, 5-nerviis; fructibus axillaribus, solitariis, longe pedicellatis, subglobosis vel late ovoideo-globosis, circiter 6 mm diametro.

A small tree (or a scandent shrub?), quite glabrous. Branches terete, smooth, somewhat reddish-brown, the branchlets slender, paler, somewhat angled. Leaves firmly chartaceous to subcoriaceous, oblong, 5 to 11 cm long, 2 to 4.5 cm wide, dull and rather pale when dry, subequally narrowed to the acute or subacute apex and to the acute base, the basal nerves 5, slender, distinct, often one or two additional nerves leaving the middle one above the base in the larger leaves. Fruits axillary or in the axils of fallen leaves, solitary, purplish-black when fresh, brown when dry, globose or ovoid-globes, about 6 mm in diam-

eter, their pedicels 5 to 7 mm long, with several minute obtuse bracteoles scattered between the base and apex, crowned by the five, usually inflexed, short, acute perianth lobes.

AMBOINA, Hoetoemoeri road, *Rel. Robins. 1810*, September 30, 1913, in forests, altitude about 80 meters, indicated thus: "tree, woody vine, small." The specimen looks as though it came from a scandent plant.

A species well marked by its fruit characters.

HENSLOWIA Blume

HENSLOWIA ROBINSONII sp. nov.

Frutex parisiticus glaber, foliis obovatis ad elliptico-obovatis, coriaceis, in siccitate brunneis, usque ad 9 cm longis, apice rotundatis, basi cuneatis, 5- vel 7-nerviis, distincte petiolatis, petiolo 0.5 ad 1.5 cm longo; fructibus breviter pedicellatis, 7 ad 8 mm longis, oblongis, sursum angustatis, subrostratis, solitariis vel in racemis 2 ad 15 cm longis dispositis.

A parasitic glabrous shrub, the branches terete, brown, the branchlets dark reddish-brown, somewhat angular or compressed. Leaves obovate to elliptic-obovate, 3.5 to 9 cm long, 1.5 to 5 cm wide, coriaceous, dark-brown when dry, dull, apex rounded, base narrowed, cuneate, slenderly 5- or 7-nerved; petioles 0.5 to 1.5 cm long. Fruits shortly pedicelled, rarely solitary, mostly in racemes which vary in length from 2 to 15 cm, the racemes sometimes with a few very greatly reduced leaves, usually leafless, the pedicels 1 to 1.5 mm long, with several minute bracteoles forming a small involucre at the base of the fruit, also with others at the base of the pedicels and usually one or two intermediate ones. Fruits oblong, reddish when fresh, brown when dry, 7 to 8 mm long, narrowed upward and subrostrate, crowned by the five, short, oblong-ovate, acute or subacute perianth lobes.

AMBOINA, Ayer putri, *Rel. Robins. 1809*, July 29, 1913, parasitic on trees at an altitude of about 10 meters, shrubby with a tendency to become scandent.

This species is apparently allied to *Henslowia reinwardtiana* Blume of the Sunda Islands, and to *H. spicata* Blume of Borneo, but is well characterized by its distinctly pedicelled fruits which are usually arranged in racemes, very rarely solitary, the racemes varying in length from 2 to 15 cm.

OPILIACEAE

CHAMPEREIA Griffith

CHAMPEREIA MANILLANA (Blume) Merr. in Philip. Journ. Sci. 7 (1912) 233.

Cansjera manillana Blume Mus. Bot. Lugd. Bat. 1 (1850) 246.
Opilia manillana Baill. Adansonia 3 (1862) 124.
Opilia cumingiana Baill. l. c.

Champereia cumingiana Merr. in Philip. Journ. Sci. 1 (1906) Suppl. 50.
Govantesia malulucban Llanos in Rev. Progr. Cienc. 15 (1865) 191.
Champereia griffithii Kurz For. Fl. Brit. Burma 2 (1877) 330.
Champereia griffithiana Planch. ex Kurz in Journ. As. Soc. Beng. 44[2] (1875) 154.

AMBOINA, Amahoesoe, *Rel. Robins. 1811*, August 30, 1913, in light woods at an altitude of about 2 meters, locally known as *sayor garing*.

The Amboina specimen certainly represents the same species as the common and widely distributed Philippine form. The species is rather variable in vegetative characters, and I have specimens of what I take to be exactly the same form from Formosa and Indo-China. Gamble[8] expresses some doubt as to whether or not the plant that occurs in Burma, the Malay Peninsula, and Sumatra is identical with the Philippine form, and retains the specimens from those regions under the name *Champereia griffithiana* Planch. Philippine material referred to Planchon's species by various authors is certainly *Champereia manillana* (Blume) Merr. The genus, at least, has not previously been reported from the Moluccas.

POLYGONACEAE

POLYGONUM Linnaeus

POLYGONUM BARBATUM Linn. Sp. Pl. (1753) 362, var.

AMBOINA, *Rel. Robins. 1667*, July 25, 1915, in a sago swamp near the town of Amboina.

Widely distributed in the tropics of the Old World.

AMARANTHACEAE

PUPALIA Jussieu

PUPALIA LAPPACEA (Linn.) Juss. in Ann. Mus. Paris 2 (1803) 132.
Achyranthes lappacea Linn. Sp. Pl. (1753) 204.
Achyranthes atropurpurea Lam. Encycl. 1 (1785) 546.
Pupalia atropurpurea Moq. in DC. Prodr. 13[2] (1849) 331.

BOETON, Baoe baoe, *Rel. Robins. 2488*, July 23, 1913.

I do not agree with Moquin in regard to the synonymy of this species, as between the two forms indicated by him as *Pupalia atropurpurea* and *Pupalia lappacea*. I interpret the type of the Linnean species as *Fl. Zeyl. 103*, and Hermann's specimen is *Pupalia atropurpurea* Moq.; see Trimen Fl. Ceyl. 3 (1895) 399.

Widely distributed in tropical Africa, Asia, and Malaya.

NYCTAGINACEAE

PISONIA Plumier

PISONIA CAULIFLORA Scheff. in Nat. Tijdschr. Nederl. Ind. 32 (1871) 417.

AMBOINA, Hitoe lama, *Rel. Robins. 1796*, October 8, 1913, in forest at an altitude of about 150 meters, locally known as *putak putak*.

[8] Journ. As. Soc. Beng. 75[2] (1912) 277.

This species was originally described from specimens collected on Ceram Island, and Bargagli-Petrucci reports it also from New Guinea. It is also cultivated in the botanic garden at Buitenzorg, Java.

PHYTOLOCCACEAE

RIVINIA Linnaeus

RIVINIA HUMILIS Linn. Sp. Pl. (1753) 121 var. **ORIENTALIS** (Moq.) H. Walt. in Engl. Pflanzenreich 39 (1909) 105.

AMBOINA, *Rel. Robins. 1662*, September 25, 1913, in waste places near the town of Amboina.

The variety is widely distributed in the Malayan region; the species, in various forms, in all tropical countries. Undoubtedly an introduced plant in Amboina, as Doctor Robinson queries "cultivated? weed?"

MAGNOLIACEAE

MAGNOLIA Linnaeus

MAGNOLIA COCO (Lour.) DC. Syst. 1 (1818) 459.

Liriodendron coco Lour. Fl. Cochinch. (1790) 347.
Magnolia pumilia Andr. Bot. Repos. *t. 226.*
Talauma pumila Blume Fl. Jav. 3 Schizandr. (1828–36) 38, *t. 12 C.*

AMBOINA, from cultivated specimens in the town of Amboina, *Rel. Robins. 501*, November 23, 1913, locally known as *sampaka salak.*

Probably a native of southern China, but occasional in cultivation in the Philippines and in the Malay Archipelago. *Liriodendron liliifera* Linn. has been cited by many authors as a synonym of this species, but it was based wholly on *Sampacca montana* Rumph., Herb. Amb. 2: 204, *t. 69*, which is *Talauma rumphii* Blume.

SCHIZANDRA Michaux

SCHIZANDRA AXILLARIS (Blume) Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 (1872) 45.

Sphaerostema axillare Blume Fl. Jav. 3 Schizandr. (1828–36) 14, *t. 3.*

AMBOINA, Hatalia, *Rel. Robins. 2005*, October 24, 1913, climbing on trees, altitude about 350 meters.

India, Java, and probably in other islands in the Malay Archipelago.

ANNONACEAE

ANNONA Linnaeus

ANNONA MURICATA Linn. Sp. Pl. (1753) 536.

AMBOINA, Binting, *Rel. Robins. 1782, September* 16, 1913, locally known as *nanka blanda.*

A native of tropical America; now widely distributed in all tropical countries in cultivation.

MYRISTACACEAE

MYRISTICA Linnaeus

MYRISTICA sp.

AMBOINA, Lateri, Way uri, and Hitoe messen, *Rel. Robins. 1877, 2033, 2042*, August to September, 1913, along river banks and in forests, altitude 50 to 300 meters, locally known as *palautan.*

Perhaps an undescribed species, but the specimens present only staminate flowers, and I cannot place it with certainty by the published descriptions alone. It is apparently not one of the forms described by Rumphius.

HORSFIELDIA Willdenow

HORSFIELDIA BIVALVIS (Hook. f.) comb. nov.

Myristica bivalvis Hook. f. Fl. Brit. Ind. 5 (1886) 107.
Myristica globularia Blume Rumphia 1 (1836) 190, non Lam.
Horsfieldia globularia Warb. in Nov. Act. Akad. Naturf. 68 (1897) 288, *t. 21, f. 1–4.*

AMBOINA, Hitoe messen, and Lateri, *Rel. Robins. 1878*, November, 1913, in forests, altitude 75 to 250 meters.

I consider that *Myristica globularia* Blume (1825) is invalidated by *M. globularia* Lam. (1788) and have accordingly adopted Hooker's specific name *bivalvis* for this species.

HORSFIELDIA sp.

AMBOINA, Hitoe messen, *Rel. Robins. 1874*, November 1, 1913, in forested ravines, altitude about 100 meters. The specimen is in fruit, and does not appear to be any of the forms described by Rumphius. I cannot definitely refer it to any described species.

MONIMIACEAE

KIBARA Endlicher

KIBARA MOLUCCANA Perk. in Engl. Bot. Jahrb. 45 (1911) 425.

AMBOINA, Hitoe messen, *Rel. Robins. 1855, 1918*, October 13, 1913, in forests, altitude about 200 meters.

The species is known only from Amboina.

LAURACEAE

PHOEBE Nees

PHOEBE MACROPHYLLA Blume Mus. Bot. Lugd. Bat. 1 (1851) 326.

Persea macrophylla Blume Bijdr. (1825) 568.

AMBOINA, Hitoe messen, *Rel. Robins. 1997*, October 14, 1913, in light forests, altitude 175 meters, locally known as *halaor batu.*

Malay Peninsula, Singapore, Java.

LITSEA Lamarck

LITSEA PERROTTETII (Blume) F.-Vill. Novis. App. (1880) 180.

Tetranthera perrottetii Blume Mus. Bot. 1 (1851) 384.

AMBOINA, Waë, *Rel. Robins. 1996*, November 25, 1913, along roadsides at low altitudes, locally known as *daun titti utan.*

The specimen closely matches *Litsea perrottetii* F.-Vill., which is very common and widely distributed in the Philippines; some of the leaves average slightly larger than in Philippine material, and some of the racemes are longer, but I can detect no essential differences. Previously known from the Philippines, where it extends from northern Luzon to southern Mindanao, and Celebes (*Hose 796*).

LITSEA BANCANA (Miq.) Boerl. Handl. Kenn. Fl. Nederl. Ind. 3 (1900) 143?

Tetranthera bancana Miq. Fl. Ind. Bat. 1[1] (1858) 950.

AMBOINA, Hitoe messen, *Rel. Robins. 1998*, November 1, 1913, borders of clearings, altitude about 200 meters, locally known as *halaor puti*.

The specimen agrees closely with Miquel's description, and with material from a cultivated tree in the botanic garden at Buitenzorg, Java, but may eventually be found to represent an allied but distinct form.

CAPPARIDACEAE

CRATAEVA Linnaeus

CRATAEVA RELIGIOSA Forst. f. Prodr. (1786) 35.

AMBOINA, Way uri, *Rel. Robins. 1905*, September 9, 1913, on river banks, altitude about 90 meters, locally known as *kayu susu*.

India to Malaya and Polynesia.

NEPENTHACEAE

NEPENTHES Linnaeus

NEPENTHES sp.

AMBOINA, Salahoetoe, *Rel. Robins. 1903, 1904*, November 27, 1913, climbing over bushes at from an altitude of 800 meters to the summit, 1,127 meters.

Both of the specimens, manifestly representing the same species, are sterile and are indeterminable except by comparison with authentically named specimens. Possibly they represent an undescribed species. The relatively large pitchers are very characteristic.

(To be concluded.)

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